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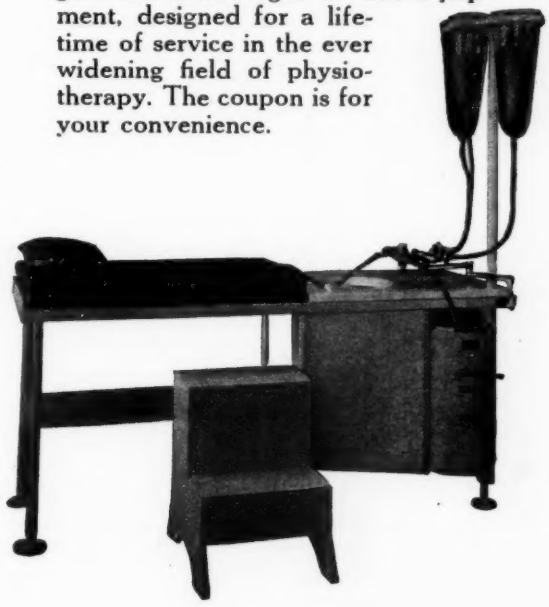

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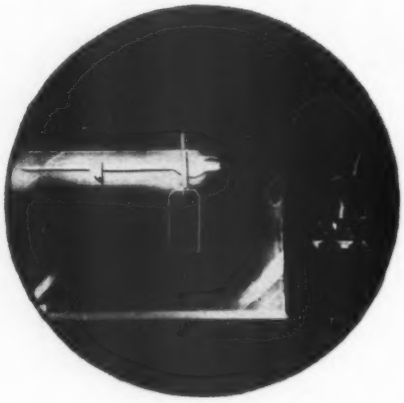

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GENERAL PRINCIPLES INVOLVED IN USE OF HEAT FOR DISEASES OF CIRCULATORY SYSTEM *

H. C. BAZETT, M.D.

School of Medicine, University of Pennsylvania

PHILADELPHIA

Physical methods have recently received a lot of attention and may become fully as useful as are drugs. They are at a disadvantage, however, since their effects are only temporary, and means have not so far been developed for applying physical agents for long periods of time. A still greater handicap is the lack of consistent scientific study of the fundamental principles involved, a lack in striking contrast with careful studies by university departments of pharmacology in the case of drugs. Future advances would therefore appear to depend to a large extent on these two factors: — (1) adequate study of the fundamental principles involved through further research work and through correlation of knowledge already attained, and (2) by the elaboration of technical methods which will allow physical agents to be employed for longer periods of time.

Factors In Use of Heat

The problems involved in using such treatment in circulatory diseases are complicated, and I propose to limit myself to factors to be considered in the use of heat alone.

It will be simpler first to direct attention to conditions involving local interference with the circulation. If the circulation be interfered with in a peripheral area, whether this occurs as the result of a structural alteration of the arteries and arterioles as in arteritis thrombo-obliterans, or as the result of a muscular spasm, as in Raynaud's disease, necrosis of the superficial tissues is apt to supervene; this may extend to a considerable depth, and may be followed by separation of the dead tissue leaving an ulcerated surface. Such surfaces are poorly supplied with blood and heal slowly. The local temperature of the part can modify considerably the development of, and recovery from, such conditions; in fact mere temperature changes can under some circumstances be the primary cause of such lesions. A case in point is "trench foot" seen in the World War, where gangrene might be caused by prolonged exposure to cold, even though this was much above the true frost-bite level. The dependency of attacks of vascular spasm of Raynaud's disease on exposure of the limbs to cold is another familiar example. In a recent analysis of this condition Lewis[1] shows that the evidence is against the presence of any hyperexcitability of the vaso-motor nerves in such a condition, but indicates that the vessels themselves constrict in an abnormally exaggerated manner on exposure to a lowered temperature. For, while temperature changes modify considerably the rate of blood flow in the normal limb, they become of even greater importance under abnormal conditions, and this is particularly the case where a spasm of the vessel wall is concerned. Even when the obstruction to blood flow depends on some structural change in the vessel, temperature changes, according to Lewis and Landis,[2] may modify the circulation to a greater extent than in the normal individual.

Where therefore the local circulation is impeded so as to interfere with the nutrition of the tissues, it is logical to determine the optimum temperature at which the part should be kept. One might be tempted to keep the temperature as high as possible where the circulation rate would be the most rapid attainable, but unfortunately other factors supervene, which negative such a simple solution. This has been demonstrated by careful clinical studies on such cases in the work of Dr. Isaac Starr of the Department of Medicine in the University of Pennsylvania, and it will be best to explain first the physiological studies that led to his work.

It was shown by Goldschmidt and Light,[3] in 1925, that the venosity of venous blood returning from a limb depended on the balance between the metabolism and the rate of blood flow, both of which were increased by rise in temperature. They demonstrated that these changes were not parallel, so that a curve resulted, in which the lowest oxygen saturation

* Read at the New York Physical Therapy Society, at the New York Academy of Science, New York, November 4, 1931.

(and greatest venosity) occurred at a definite surface temperature of about 25° C. (77° F.). At high temperatures the circulation rate was increased so greatly that the venous blood contained large amounts of oxygen even though the metabolism was undoubtedly much increased (see Fig. 1 curves b). However, when the circulatory system is diseased a similar relationship cannot be foretold, since the rise of temperature will increase tissue metabolism, while the circulation rate may be unable to exceed some critical value owing to the vascular lesions. A further rise in temperature beyond a critical point might then affect the circulation-metabolism balance unfavorably. Dr. Starr[4] consequently has utilized the fundamental observations of Goldschmidt and Light, and has determined by careful clinical observation the temperature at which the circulation of the part appears optimal in the individual patient. With rise of temperature pain is much relieved and cyanosis of the skin may disappear; if however the temperature be further raised both pain and cyanosis may reappear. When the highest surface temperatures allowable have been thus determined, he has employed a thermo-regulated heated tent, so that the part may be kept for days at the most suitable temperature. He finds that the healing processes in patients with commencing gangrene are in this way very much improved. A preliminary account of his work will be published shortly in the Proceedings of the Society for Exp. Biology and Medicine. It may be merely mentioned here that the critical temperature, which should not be exceeded, varies from patient to patient and may be surprisingly low — much below 37° C. I think you will agree that this example supplies a good illustration of the possibility of improving physical therapy treatment in a simple manner by the consideration of relatively simple physiological principles, but I feel that very careful study is necessary before these procedures can be applied in the most efficient way in cases with a different pathology, for the changes introduced by altering even the local temperature are complex.

Complex Nature of Temperature Alteration

When the temperature is altered not only is the oxygen saturation of venous blood changed, but physico-chemical factors are brought into play, which considerably modify gas tensions by altering the dissociation of oxyhemoglobin and by modifying the acid-base balance and blood pH (see Fig 1). Consequently a rise in temperature increases enormously both the oxygen and carbon dioxide tensions to a degree which quite outbalances the smaller effects produced by variations in venosity. The effect of the pH changes may be demonstrated by curves obtained for gas tensions in the subcutaneous tissues of the forearm immersed in water baths at different temperatures (Bazett and Sribyatta)[5], Figs 2 and 3. The relative importance of these factors on healing processes is however hard to estimate, particularly in patients with abnormal circulations.

Yet another factor to be considered, and undoubtedly of importance in circulatory disorders, is the effect of heat on the capillary circulation and on the formation of tissue fluid. When heat is applied to an area the superficial capillaries and veins are obviously dilated, and through a relaxation of arteriolar tone the blood flow is much increased. The latter factor should tend to raise pressure within the capillaries, and Landis[6] has demonstrated in man that the capillary pressure is definitely raised to a considerable degree. Thus while in the skin of the finger he obtained under normal room conditions pressures of about 32 mm. Hg in the arteriolar limb of capillary loops, and about 12 mm. in the venous limb, he found these values raised to 60 mm. and 45 mm., respectively, when the skin temperature was raised to about 42° C. (107.6° F.). Since the osmotic pressure of the plasma proteins in man is about 26 mm. Hg, this implies a filtration pressure for edema formation equal to the difference, or some 25 to 30 mm. of Hg. Presumably this fluid would drain away through lymphatics, under normal conditions.

Edema In Relation to Temperature

That this factor is not imaginary is demonstrated by the study of edema formation in the normal individual made by Drury and Jones.[7] These workers determined the rate of edema formation in the foot and leg, when venous pressure was raised by applying to the thigh a Riva Rocci cuff blown up to a moderately high pressure (20-60 mm. Hg). They found the rate of swelling of the leg in a bath at 16° C. with a cuff pressure of 60 mm. about equivalent to that observed at 36° C. without any venous obstruction except that

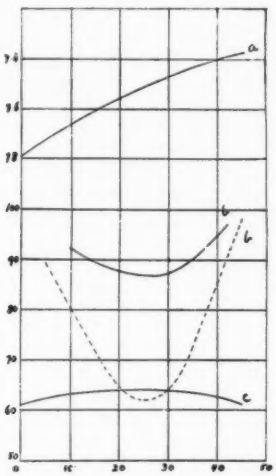

Fig. 1. The effect of surface temperature changes on the blood from a hand vein of one subject; the curves represent (a) pH, (b) O_2 saturation and (c) CO_2 content of plasma (Bazett and Sribyatta). The dotted curve represents the average effect (on many subjects) of such surface changes on the oxygen saturation of venous blood from the arm (Goldschmidt and Light).

caused by gravity. In general the fluid formation under otherwise similar conditions was 2 to 5 times as rapid at 42° C. as at 16° C. In this work true edema occurred, since lymphatic drainage, like venous return, was impeded by the cuff pressure, as well as to some extent by gravity.

The results of these workers can be interpreted by assuming a linear relationship between rate of edema formation and the difference between capillary pressure and the osmotic pressure of plasma proteins, a relationship, according to Landis,[8] demonstrated by many experiments to be valid. On this assumption the effective filtration pressure may be estimated for the various conditions of Drury and Jones' experiments. The results so obtained are shown in Fig. 4. Since the osmotic pressure of plasma proteins has a value in man of some 26 mm., the capillary pressures for the various conditions can also be estimated. The rate of circulation through the limb under the experimental conditions was also directly determined by Drury and Jones. These further relationships are shown in Fig 5, which demonstrates how a rise of surface temperature so modifies the local circulation as to cause increased circulation rate. raised capillary pressure, increased rate of edema formation when the venous pressure in the thigh is maintained at a constant level, and also how the critical venous pressure, above which fluid transfer to the tissues occurs, is affected by the surface temperature. It will be seen that such an analysis implies that with surface temperatures above 35° C. fluid transfer is continuous, and continual lymphatic drainage must take place. While the quantitative estimates of these values may have to be revised, the general conclusion is probably valid and should be considered in the use of heat. A rise of temperature must be expected to greatly increase lymphatic drainage and this may be of value in modifying diseased conditions. It may, however, also prove to be a detriment in certain conditions, and, where lymphatic drainage is obstructed, fluid might collect in the tissues giving a gross recognizable edema. Under such conditions the collection of fluid might cause pressure on venous channels and so secondarily interfere with the circulation. Edema is not detectable by clinical tests (pitting) until a collection of at least 8 cc. per 100 cc. tissue has occurred.

In addition to this fluid transfer, dependent on capillary pressure, an edema formation of an inflammatory character is caused by higher temperatures. If the temperature of the subcutaneous area is raised to about 42° C. and maintained for an hour or more at this level, slight injury is caused, and the capillaries are probably rendered partially permeable to proteins. At any rate there may result a slight superficial edema which may last for a day or more. The temperature ap-

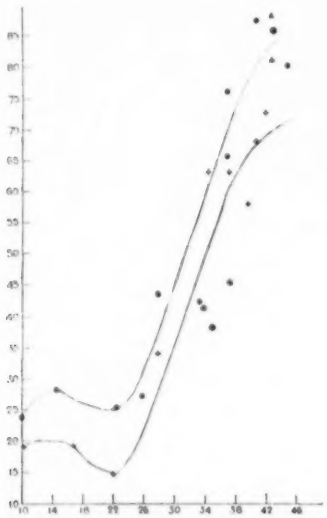

Fig. 2. Oxygen tensions in subcutaneous tissue of forearm plotted as ordinates against surface temperatures as abscissae in two subjects.

plied to the skin surface which causes such a result varies with the rate of circulation through the skin. When this is rapid a bath of 45° may be only just sufficient to cause the necessary rise of local temperature within the tissues, owing to the maintenance of a lower temperature level in the skin by the rapidly flowing blood, while in another subject with slower circulation a bath the temperature of which does not exceed 42° to 43° may cause a slight burn of this type.

Mode of Heating May Modify Results

The mode of application of heat may modify the results. If radiant heat from a lamp be used, the heat will be accompanied by some desiccation of the surface. If the circulation of air be impeded by a rubber cover, this desiccation may be much diminished. If a water bath be employed, the epidermis absorbs water, and becomes sodden and puffy, but no ill effects appear to be induced even with immersion for hours or days. If saline baths be employed, this absorption of water by the skin can, I believe, be avoided, and it is possible that a highly concentrated saline bath may even tend to withdraw fluid from the skin and sweat glands by osmosis. If baths of a spray character be employed so that the water meets the tissues with a varying pressure, some of the effects of massage will result and blood and lymph will be moved centripetally.

Electrical methods for raising temperature by the use of high frequency currents have a considerable value, since they can be applied more readily, than can other methods, to any desired area. Diathermy currents derived from machines of relatively low voltage, raise the temperature mainly on the surface and can be demonstrated to have relatively slight heating effect on the deeper muscles, bones or joints. Heating of these deeper areas is produced mainly by conduction of heat, and electrical heating effects are a minor factor. The circulation distributes the heat throughout the body, so that, though it is easy to heat an area up to the level of the deep body temperature (and this may constitute a considerable rise in a limb where the normal temperature is much below that of the central part of the body), it is almost impossible to heat one part specifically more than 1° or 2° F. above the central body temperature level. The conditions, however, are probably somewhat different when a high frequency radio machine working on a condenser basis is employed, and the same may be true of diathermy machines working at high voltages. The data suggest that, in the first case at any rate, there is a considerable generation of heat from electrical energy in the deeper tissues, and measurements by Schliephake[9] suggest that the rise of temperature in bones may be almost as great as that observed on the surface.

It should, however, be emphasized that when local effects are desired, heat is likely to

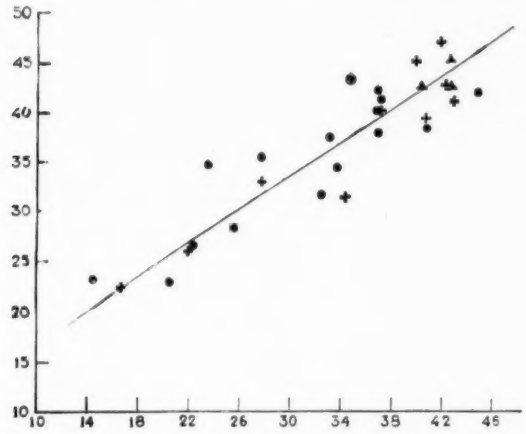

Fig. 3. Carbon dioxide tension in subcutaneous tissue of forearm plotted as ordinates against surface temperatures as abscissae in two subjects.

prove most useful if applied in the simplest possible manner, so that the patient can give his own treatments under direction and continue them for much longer periods than is possible with more complicated methods.

In the relation of baths to edema it should be emphasized that within the water bath, veins and tissues are exposed to pressures dependent on the depth of water. Though, under these circumstances, venous pressure varies with gravity, the pressure of tissue fluid varies in a similar manner so that within a bath, the effect of gravity is obliterated as far as the filtration pressure in the capillary is concerned. A person immersed in a bath in a standing position is from the point of view of his circulation in a similar condition to one lying absolutely flat, except that the inside of his thoracic cavity is protected from the pressure of the water. Consequently pressure in the large veins within the chest may be abnormally low in proportion to that in other veins, and venous return be somewhat facilitated. If the subject was lying flat in the bath, there would similarly be no greater tendency for fluid to collect on his back than at any other part.

General application of heat to the whole body gives much more complicated effects and it is hardly possible at present to analyze the results satisfactorily, nor to predict the exact effect on the circulation.

Exposure to moderate cold induces vasoconstriction of the skin vessels, but metabolism may be stimulated and, consequently, the vessels supplying the muscles dilated. The circulation rate (minute-volume) is in some subjects at any rate unchanged, in other subjects it may perhaps be increased (particularly if the cold is rather extreme), but certainly it is not reduced, except as a terminal event accompanying a profound fall in deep body temperature. The pulse rate is slightly slowed, probably as the direct effect of slight changes in body temperature on the heart itself. The balance of superficial constriction and deep dilatation is usually such as to give an increased peripheral resistance, for both systolic and diastolic pressures are increased. The order of magnitude of these changes may be seen in Grollman's[10] observations on the effect of exposure of a clothed individual to a room at 0° C. in comparison with values recorded at 20°; the pulse rate was unchanged or very slightly reduced (1½ per cent), the circulation rate remained unchanged, systolic pressure rose from 106 to 116 mm. and diastolic pressure from 62 to 70 mm. With an unchanged output the work of the heart was probably therefore increased some 10 per cent through the increased resistance and consequent rise in systolic pressure.

On exposure to mild warmth on the contrary, there is a general dilatation of superficial vessels, but some compensation is attained through constriction of deeper vessels. The circulation rate is increased some 29 per cent. For instance, Grollman found exposure to an air temperature of 42° increased the minute volume of one subject from 4.2 liters per minute to 5.4 liters, and in Grollman's subject this was accompanied by an increase in pulse rate from 58 beats per minute to one of 76 (increase of 31 per cent) with a fall of

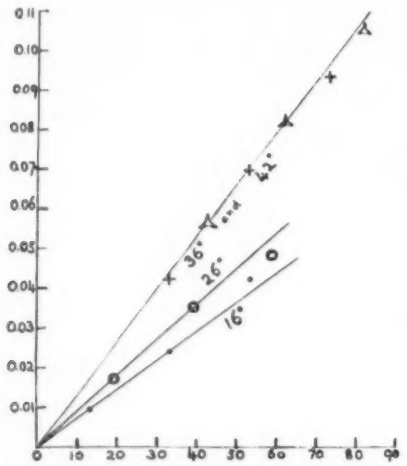

Fig. 4. Relation of rate of edema formation to pressure at different temperatures calculated from data of Drury and Jones. Abscissae: estimated filtration pressure (capillary pressure — osmotic pressure) in mm. Hg; ordinates cc. of edema fluid formed per 100 cc. tissue per minute. Data at 16° o——o : data at 26° o——o : data at 36° + — + : data at 42° △——△.

systolic pressure from 106 to 100 mm., but without change of diastolic pressure. According to such measurements the work of the heart was increased even more than on exposure to cold (an increase possibly of some 22 per cent or more). In addition the heart had to beat more rapidly. Though more blood was circulated it probably passed to a considerable extent to the skin and left the deeper tissues none too well supplied.

Influence of Heat On Heart Action

Any exact estimate of the work of the heart is impossible since it depends on the heart output and the resistance to be overcome as well as on the velocity given to the blood. These latter factors vary during a single systolic contraction, and their mean value can at best only be estimated approximately, but if velocity energy be neglected, and if the assumption be made that the mean resistance to outflow is that of systolic pressure (one obviously partially untrue), then an approximate estimate of the work of the heart in Grollman's experiments may be calculated. The minimum work for the heart in his experiments thus estimated is found with an external temperature of 30° C. (of low humidity). Taking this value as the standard the value with exposure to ordinary room conditions (20° C.) would be some 5 per cent higher, to cold air (0° C.) 15 per cent higher, to hot air (42° C.) 27 per cent higher, and to still higher temperatures (45° C.) 35 per cent higher.

A mild exposure to warmth would therefore appear to decrease the load on the heart to a minimum, while any change in either direction would raise it. A rise of temperature above the optimum is apt to be more serious than a fall. However, any exact estimate of the real level for minimum work for the heart must await better methods of measuring blood pressure. It should be noted that in Grollman's experiments the minimum metabolism occurred at the same temperature (30° C. dry bulb temperature) as that estimated for minimum work for the heart. This temperature for minimal metabolism varies with the air humidity — it is probably one giving surface temperatures on the exposed skin of about 35° and could be duplicated by warm baths at 35° to 36° C. (95° to 97° F.).

Exposure to higher temperatures is desirable even in some cases with circulatory disorders, since it may prove a useful means of ridding the body of fluid through sweating. Under such circumstances the work of the heart is probably temporarily increased, possibly 30 or 50 per cent or even more, but ultimately the subject gains. The changes in blood pressure and pulse rate that may be observed under such conditions in a normal subject were indicated by the author[11] in an earlier paper (Figs. 1 and 2). In the first of these experiments the subject was immersed in a

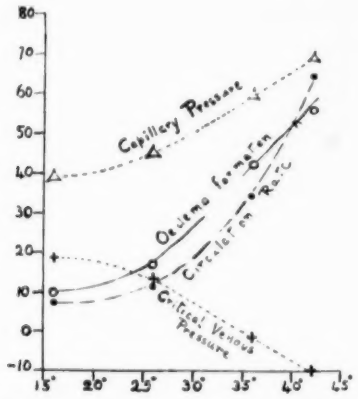

Fig. 5. Effect of temperature on rate of blood flow and rate of edema formation with veins compressed by a cuff at 20 mm. Hg; with estimated capillary pressure under these conditions and estimated critical cuff pressure for edema formation. Abscissae: temperature of bath in ° C.; ordinates: capillary and venous pressure in mm. of Hg, rate of blood flow in 0.1 cc. per 100 cc. of tissue per minute, rate of edema formation in 0.001 cc. per 100 cc. per minute(i. e. 10 = 0.010 cc. per 100 cc. per minute).

luke warm bath, and the temperature of the water was then gradually raised. The subject lost 1.08 kilograms in weight, or 0.36 kilograms per hour, of which 0.08 kilograms per hour was lost in sweat during an exposure of 3 hours. The subject was throughout comfortable, though the body temperature eventually rose to 38.5° C. (101° F.). The pulse rate rose only from 65 to 81 (increase of 25 per cent), while both systolic and diastolic blood pressures fell; the pressures changed from 104/75 to 80/47 (fall of 23 per cent in systolic pressure), so that the heart is unlikely to have had its work much increased. However during the last hour the systolic pressure again rose and at this time increase of work for the heart may have become important.

In the second experiment, the subject went suddenly into a hot bath at 39.8° C. (103.6° F.) and the reactions were much more severe. This temperature represents quite a warm bath if the water is rapidly stirred, as was done in this case. Though the bath temperature was allowed to fall gradually, the body temperature rose rapidly to 38.6° C. (101.5° F.) and then was maintained relatively steady; the initial rise was at a rate of increase of 4.7° C. (8.5° F.) per hour, as compared with less than 0.7° C. (1.25° F.) per hour in the other experiment. The pulse rate rose rapidly from 68 to 98 (increase of 45 per cent), the systolic pressure fell very little, and though no estimate of circulation rate can be made, the work of the heart was probably considerably increased. The subject was quite distressed, mentally confused and was quite incapable of getting out of the bath without assistance.

The most prominent symptoms were respiratory. Loss of weight was at the rate of 0.52 kilograms per hour, of which about 0.25 kilograms per hour depended on sweating (3 times as rapid as in the other experiment). The production of a rapid rise of temperature, as in this case, creates a considerable strain on the individual and though more effective in sweat production than milder procedures, this gain is counterbalanced by the other factors. Exposure to heat should therefore be made gradually and should not be allowed to raise the individual's temperature more than 1° or 2° F. per hour at most. If carefully used, it may be employed for a long period of time.

Effect of Temperature On Metabolism

Accompanying the rise in body temperature a profound respiratory reaction may be observed, which may cause the subject considerable distress. The degree of this reaction varies considerably even in normal subjects, and the degree to which this respiratory change affects the circulation also varies. The increase in respiration is usually mainly an increase in depth, though the rate is also somewhat increased; it cannot be considered as cooling mechanism (as in the dog) which is characterized by a fast shallow respiration. The respiratory reaction is greater the faster

the rate of rise of temperature, though as indicated by Landis and his co-workers,[12] the temperature level reached also plays a part.

As a result of the respiratory changes, the blood becomes much more alkaline (though the direct effect of a local rise in temperature is to make it more acid). This may secondarily have an injurious effect on the heart, and may also be a factor in the causation of the rise in systolic pressure often seen in later stages of exposure to heat, since alkalosis may induce some vasoconstriction. Such a respiratory response should certainly be avoided in cases with circulatory disorders by keeping the rise of body temperature small and preventing any rapid change. If any marked respiratory distress of this type occurs, it can be combated successfully by making the subject breathe a mixture of 6 per cent carbon dioxide with oxygen. The alkalosis with hyperthermia is probably unavoidable, except possibly by the respiration of CO_2 containing gases. It has been described by Koehler[13] in fever and observed as the result of pyrexia caused by diathermy by Bischoff and co-workers.[14] Changes in pH of 0.23 to 0.33 to the alkaline side with attainment of plasma pH values as high as 7.70 and 7.74 have been described.

It may be noticed that in the cases so far described a warm bath has been used to induce sweating instead of the more common clinical method employing hot air. I believe the bath to be much preferable. Sweating occurs just as freely in water as in air, as may be demonstrated by the loss of weight of the subject and by analysis of the water. Indeed it is possible that sweating may occur more rapidly in baths than in air, particularly in salt baths. On the latter point I know of no adequate data, though it is certainly conceivable theoretically.

The relative value of the various methods can be readily tested on patients, for the loss of weight of a subject by sweating may easily amount to 1 kilogram (2¼ lbs.) or more per hour, and the loss of weight (corrected for any water drunk or urine passed) may be taken as an approximate measure of the loss of sweat. For though weight is also lost through the lungs by water evaporation, and through the difference in weight of CO_2 exhaled from that of oxygen inhaled, these other factors are small enough to be neglected in rough measurements. Water loss by the lungs is less valuable clinically than that lost in sweat since it is unaccompanied by loss of salts, etc. If the subject breathes ordinary room air the water loss in the lungs only amounts to some 10 to 30 gm. per hour, a negligible value in proportion to the loss in sweat (200 to 1000 gms. per hour), and the second factor is even more negligible, for it rarely amounts to more than 1 to 3 grams per hour. I know of no adequate comparison by such simple means of the relative value for patients of different methods for inducing sweating (hot air, diathermy, warm baths, warm salt baths) but, from experiments on myself and others, I have no doubt that baths will not prove inferior.

Baths, in addition to being simple to use, have some definite advantages, and, I believe, only one serious disadvantage. In patients with circulatory disorders the profound vascular dilatation produced by heat causes a considerable strain on the circulation, particularly since the marked dilatation of the large veins may diminish the return of blood to the heart. With sweating and loss of fluid, diminution in blood volume may occur, which is advantageous for the absorption of edema fluid, but which exaggerates the interference with venous return to the heart and may lead to shock-like symptoms with restlessness as a prominent feature. In a bath such changes are less likely to give serious symptoms since the subject is lying down, pooling of blood by gravity is prevented by the water pressure, and extreme dilatation of superficial veins absorbing blood needed for other areas is also to some extent counteracted by the water pressure.

Yet another factor which may be advantageous is that in the normal subject, baths induce a temporary increase in the rate of urine formation. This may be quite considerable in the normal subject, and might prove an advantage, if it occurs similarly in the abnormal subject. It is true that it might also prove disadvantageous if it throws any extra strain on the kidney, but at present it does not appear possible to guess what the effect would be, nor even to estimate the mechanisms concerned in the diuresis. In some way it appears to be dependent on the water pressure for it may be duplicated by applying mild pressure to the abdomen by large air bags of the Riva Rocci type as shown by Griffith and Hansell.[15] Whether the pressure so applied

increases the rate of intestinal absorption, and so secondarily affects urine formation, or whether it alters the pressure in the renal vessels and so affects directly filtration in the glomeruli or reabsorption in the tubules is unknown. It appears more likely to be a beneficial than an injurious effect. It is certainly not dependent on absorption of water through the skin.

The only dangerous factor in baths is the rapid rise of body temperature that may result if the bath is too warm. Only mildly warm baths of 99° to 101° F. or less should be employed; they should be constantly stirred, so that an even temperature is maintained.

Another valuable type of bath may be one saturated with carbon dioxide, as in the natural water at St. Moritz, reported by Liljestrand and Magnus.[16] Such baths at 33° C. induce vasodilatation in the skin, either with or without some slight increase in circulation rate; they cause little change in blood pressure, and a slight slowing of the pulse rate. There is a fall of body temperature of 1° C. or more (2° F.) without any metabolic response to the change and without discomfort. Somewhat warmer baths (at 35° or 36°) of such CO_2 containing water should prove particularly beneficial in lowering the work of the heart without inducing sweating. Such baths are, however, as you know, hard to reproduce artificially.

Lastly, profound effects may be produced on the circulation reflexly as by cold douches, etc. I do not, however, feel competent to discuss such effects which are likely to be extremely complicated.

The use of electrical methods for producing a general heating of the whole body is common, but I do not know of any special advantage obtained by their use, except that the relative importance of direct and reflex effects on the circulation may perhaps be somewhat modified according to the method of heating used; however this question at present has not been adequately studied. They may occasionally have advantages when it is desirable to raise the temperature of some part of the body specifically to a greater extent than that of the body as a whole. When the body temperature is to be raised to any considerable extent, it seems certain that this must be done under the direct supervision and control of the physician, so that there is less objection to the employment of the more complicated methods.

Conclusions

In conclusion I should like to apologize to you for having given you information so small and of such poor practical value, but I think that even from this failure, a lesson may be drawn. No laboratory worker is likely to cause continuous advance in the practical application of your subject. He may at times chance on some point of clinical importance, but if so, he is often incapable of recognizing its clinical value. Advances must come from the clinician, but they are not to be anticipated unless the clinicians set out, more than they have done in the past in this field, to organize investigation of their cases as research problems, problems necessitating accurate observations with exact laboratory methods. The clinical laboratory worker in the field of physical therapy needs to be developed. Both physical and physiological methods would have to be employed, and apparatus would need to be redesigned and adapted for the necessities of the moment. Naturally this could only be done in the larger hospitals and medical schools, and the elaborate methods of measurement which would certainly prove necessary would have to be discarded again later, once they had done their work. For they would probably allow simple, empirical rules to be re-established, but these rules would rest on a much sounder foundation of scientific fact and analysis, and not so much as at present on mere clinical observations however acute. In such a program the physicist and physiologist should play a part, but not the leading part, which can, I think, only be played by the physician.

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Proper Place of Physical Therapy in Treatment of Fractures

Clay Ray Murray, New York (*Journal A. M. A.*, July 25, 1931), is convinced that physical therapy, properly used, can be of great value in minimizing residual disability and deformity and in cutting down the period of treatment necessary to secure an end-result; he is equally convinced that, as generally practiced the country-wide today in fractures, it frequently accomplishes neither of these objects but results in increased residual disability and prolongs the time needed to secure the end-results. The fault lies in a generalized failure to realize (1) what treatment of fracture is intended to do, (2) what physical therapy can and cannot do and (3) what part the patient plays in the treatment. The fault is shared equally by the physicians and the physical therapists to whom they send the patients. The result is commonly the neglect of physical therapy during that stage of treatment when it is most valuable, and the attempt in the later stages to substitute physical therapy for the patient's part in the treatment. Physical therapy as a method of treatment in fractures can be put on a sound logical basis. One might ignore for the moment the various means of carrying out the treatment and consider what it should do to be of value. How does it fit into the modern conception of treatment of fracture? The ideal treatment of a fracture would embody the immediate anatomic replacement of bone fragments without mental or physical trauma to the patient and the immediate abolition of all pathologic changes in the bone and soft parts without the slightest interference with the usual function of the part or the usual life of the patient. The problem in each fracture is to approach this unattainable ideal as closely as one can. This is accomplished in general by early reductions under anesthesia, by the employment of a minimum of immobilization for as short a time as possible and by allowing and encouraging the active use of the part within pain limits as soon and as often as possible. The value of these principles of treatment is being more widely appreciated constantly. What is not so widely appreciated is the fact that in the part as a whole there exists an extensive pathologic process: torn and thrombosed vascular and lymphatic channels, lacerated tissues infiltrated by hemorrhage, inflammatory exudate with its cellular constituents, and the transudate of edema from circulatory and lymphatic obstruction. More than that, the organization of such infiltration into tissue is rapid. It is measured in hours and days — not in weeks and months. It can be dispersed while it is exudate, hemorrhage and cellular infiltration, and this is the time to attempt to get rid of it, not after it has become organized and can no longer be dispersed. How is it to be removed from the part? There is only one mechanism — circulatory. The problem is to restore the circulatory status of the part to normal as soon after the injury as possible.

ON REDUCING AND TREATING CERVICAL DISLOCATIONS *

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The increase in traumatic surgical conditions has brought with it proportionate increase in the incidence of dislocations of the cervical spine. Many continue to be household accidents rather than industrial injuries. The treatment of this grave dislocation has too often been purely symptomatic. That is, the neurological surgeon did a decompression of the cord where cord pressure was evident. We have been unable to find any record of a recovery following cervical laminectomy for severe pressure on the cord in this injury. Taylor[1] of New York, explains the reason of failure in vivid language. Jackson[2] has recently reported two cases of successful open reduction without laminectomy. The conservative members of the profession endeavored to prevent further damage by immobilizing the head and neck with plaster casts, celluloid collars, or apparatus of leather and metal.

The last two or three years have seen a gratifying number of successful closed reductions reported. As early as 1889, and again in 1904, Walton[3] described a technic for the closed, or manipulative reduction of this dislocation. His method of "retrolateral flexion with rotation" is anatomically sound and technically efficient. In 1924, Taylor[1] published his method of immediate extension and manual reduction. This makes possible the correction of dislocations accompanied by such fractures or extreme anterior displacement of the vertebra that the surgeon may hesitate to employ the rotation of the Walton maneuver. We have not seen the method of Binnie[4] in use, though Jackson[2] reports its successful use in two cases. Binnie uses a laparotomy sheet to lift the head straight up while the patient is seated, to permit manipulative movements. When the Walton method is unsuccessful, or traction is indicated, it seems to us that Taylor's method gives the operator much better control of the patient and offers fewer possibilities of additional injury to the cord. Also it permits anesthesia, if needed, and leaves the patient in position for the application of plaster cuirass without further movement.

Nearly every writer on the subject of cervical dislocations mentions the fact that such cases are usually overlooked by the physician first in attendance. Moore[5] has stated frequently, in print and by word of mouth, that they have been, and are, overlooked in radiographic study also. This leads to unfortunate delay in treatment and the development of sundry complications in the reduction of the vertebra. It has been thought that ligaments and tendons stretch to permit dislocation of a vertebra without tear or fracture. However, work done by Williams[6] would indicate that tendons and ligaments neither stretch nor contract. He feels that all such apparent changes in length and thickness of these structures are in reality due to changes in muscle fibre, not tendon fibres. Shortening of muscles of the neck undoubtedly does occur in the traumatic torticollis following dislocation. If fibres are torn in either ligaments or muscles, obviously, scarring or fibrositis will follow. These make delayed reductions proportionately more difficult. Jackson[2] advises the postponement of reduction of the atlas for from four to six weeks for fear that the odontoid may be already fractured and may suffer additional damage by the manipulation. We question the advisability of this for the reasons stated. Fracture of the odontoid does add materially to the risk. It is one of the things to be carefully considered in the diagnosis and plan of treatment.

The care of muscle and other soft tissue changes call for the usual aid of physical therapy here as elsewhere. This easily falls into pre- and post-corrective treatment. The latter is not dissimilar to the measures proper for any dislocation after a prolonged period of immobilization.[7, 8] It must be remembered that there are numerous vertebra and many more actual joints involved in the immobiliza-

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Fig. 1. Shows clearly the limitation of rotation of the head to the right. The chin is well to the left of the midline. This is the typical attitude of a case of rotary dislocation of the atlas.

tion required to protect the head and neck after reduction. Nor shall we attempt to enumerate the ligaments, tendons, and muscles that may have scars and fibrous changes. We know that after immobilization of from six weeks to twelve months we shall have a patient with head and neck held rigid and with but scant active motion possible. Passive motion is of course out of the question. Various forms of heat, massage, and muscle training will be required to bring about mobilization and restoration of tissue function. Such means will gradually restore tissue usefulness and the patient's confidence. The psychological effect of an injury of this sort is severe and calls for careful and delicate surgical, physical, and psychical therapy.

Citation of a Specific Case

The particular object of this paper is to bring before you the use of physical therapy in the preparation of a dislocated neck of long standing, in order to make possible a successful reduction. To make the situation graphic, we shall first report a case and then discuss it: —

M. McC., white, female, single, 19 years of age, college student, referred to Department of Physical Therapy of Barnes Hospital by Dr. Warren Rainey, because of wry neck. Her history was that she had had tonsilitis in January, 1930. Shortly thereafter, developed swelling of left side of neck. Tonsillectomy under ether on March 30, 1930. After this, the hard swelling on the left side of the neck softened and there was purulent discharge from the mouth, but the deformity persisted and was quite extreme. Since then she had had treatment by various doctors and osteopaths, including heat and manipulations. She thought the condition had improved somewhat, but the deformity continued.

Examination October 30, 1930 by Drs. Ewerhardt and Brookes showed chin carried toward left shoulder and head tilted toward right shoulder. On any effort to rotate the chin toward the right side the anterior fibres of the left trapezius stood out sharply. Head could not be rotated farther to the right than the midline and would not remain there unless held. Neck elongated and thin. Beginning hemifacial atrophy, right. No gross neurological changes. X-rays at Barnes Hospital reported by Dr. Sherwood Moore as "Rotary Dislocation of the First Cervical Vertebra."

On November 4, 1930, attempts at reduction by the Walton and Taylor methods, without anesthesia, were unsuccessful. The soft tissues of the neck were firm and unyielding. For three weeks the patient received radiant heat, diathermy, massage, and rhythmic traction of the head and neck, six times a week. On November 24, 1930, at Barnes Hospital, under gas-ether anesthesia, examination showed easy rotation of the head to the left with no muscle spasm, but rotation to the right came to an abrupt stop when chin was still to the left of the midline. This bony block was caused by the malposition of the right lateral mass of the atlas, which x-ray had shown to be displaced anterior to, and below the level of, the right articular process of the axis.

The dislocation was then reduced by closed operation, using the Walton maneuver with Langworthy's addition. The patient was placed on her back, head

Fig. 2. Posterior view of the same case. Shows typical rotary limitation of the neck as the patient tries to look to the right. The left lateral deviation of the entire cervical spine and the spastiscity of the upper quadrants of the trapezius muscle are well brought out.

and neck were brought beyond the end of the table. With the operator's right hand flat against the right side of her head and his left hand cupped under her chin, the head was rotated steadily to the left, beyond its usual range, until we felt that the lateral mass of the first cervical had been actually rotated away from the anterior face of the second cervical. Still holding this rotation, the head was then flexed laterally to the left, using the left lateral mass as a fulcrum, until we were assured that the right lateral mass of the atlas had cleared the level of the articular process of the axis. Next, maintaining the lateral flexion, the head was rotated to the right beyond the midline. With the articular surface of the atlas now lying directly above its fellow of the axis, the head was brought to the vertical again and the vertebra allowed to seat itself home.

Each step of the manipulation was accompanied by clear bony crepitus and a definite click, palpable to the operator and audible to the assistants. These were confirmatory evidence of the sufficiency of each portion of the maneuver. No traction was employed, but enough steady force was used to complete each step as we went along. The chin now rotated freely through practically normal range. Plaster cuirass was applied from top of head to waistline; with chin a trifle to the right of the midline and with occiput extended. X-ray through the cast, and later without the cast, verified complete reduction.

We find ourselves unable to conclude exactly what caused the dislocation. There was a severe infection of the throat and neck. We are a bit skeptical of the interesting explanation offered by Berkheiser and Seidler[9] in their report of five cases of "Non-traumatic Dislocations of the Atlanto-Axial Joint." We feel that respiratory tract infections, or purulent infections, may weaken the atlanto-axial ligaments or may cause contractures of muscles, but the final displacement is more likely to be caused by some trauma, be it only cough, sneeze, or unexpected twist of the neck.

Minor Accidents May Cause Displacements

One of our patients had jumped hurriedly from bed. He suffered a "crick in the neck" as a result and a fixed torticollis. X-ray showed not only a partial rotation of the lower articular facet of the second cervical vertebra on the right side, but a chip fracture of this same lower articular process. So very minor accidents may cause serious displacements in the neck when the muscles are caught off guard, permitting the "flying start" of Corner.[10]

In our case, the original infection occurred in a distant city and the check-up could not be accurate. We thought of the tonsillectomy and the sudden twist sometimes given by the anesthetist to permit the patient to spit out the blood, but the patient thinks not. She awakened one morning to find that the wry neck which she had had for some weeks, was now a fixture and she could not correct it at all. At any rate, she had a fixed dislocation

Fig. 3. Front view of same patient after reduction and removal of appliances.

of the first cervical, with the right articular facet completely displaced anteriorly. The soft tissues of the neck were tense and fibrosed. The first efforts at reduction were of no avail. After careful preparation of heat, massage, and rhythmic stretching of the neck, it was possible to accomplish perfect reduction and restore to social life and economic usefulness an individual who had considered herself doomed to life as a deformed cripple.

The seriousness of this situation can be understood when we tell you that the patient and her parents came to us separately and asked the risk of the proposed attempt. We frankly told them that it was serious. Each in turn volunteered the opinion that it would be better for her to die in the attempt than to try to go on living in her existing condition, even though she was the only child of devoted parents. Her pluck and intelligence were shown when we saw her less than fifteen minutes after leaving the operating room. She was only partially out of the anesthetic, but realized that her head was to the right for the first time in nine or more months. Her first words were, "Congratulations, Doctor!"

A second plaster cuirass was applied on December 5th, with the patient in the sitting position, to enable her to get about comfortably. On January 13, 1931, a celluloid "doll collar" was applied. Thereafter, regular diathermy and muscle training were instituted. At present, the patient has normal range of motion in all directions. Wears no protection, except when she is fearful of going in an auto for a long trip. The facial asymmetry has cleared.

This patient is one of a series of twenty-nine cases of dislocations of the neck, with and without demonstrable fracture, seen by one of us. Sixteen of these have been previously reported.[11] This individual case stands out in the series for the following reasons: —

1. Severity of the displacement without severe trauma.

2. Lapse of time — nine months duration. The nearest approach to this length of time preceding successful reduction that we have found, was in the remarkable series reported by Langworthy.[12] He states, "Manipulation done as late as eight months after injury was successful."

3. Physical therapy measures alone had failed as had manipulation alone. Systematic physical therapy, followed by correct manipulation brought success in startling fashion.

Conclusion

Physical therapy is highly desirable in the successful treatment of dislocation of the cervical vertebrae. After reduction, it will restore mobility. Before reduction, in long continued dislocation, it has in at least one case, made correction possible.

Fig. 4. Same case. Note the rotation possible to the right, as contrasted with the limitation in Fig. No. 1.

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Discussion

Dr. F. W. Nelson (Ottumwa, Iowa): I have seen several of these cases in practice, and to those who are interested there was published a very good article in one of the January, 1930, issues of the *Jour. A. M. A.*, which describes the malady very thoroughly. I am sorry I did not know that a film would be presented in conjunction with the paper. I have one which especially shows the fourth vertebra dislocated forward over the fifth, a complete dislocation indeed. This patient was completely paralyzed. In his statement the doctor said it was necessary to make traction of these cases by manipulation. It has been my experience that here considerable traction is required.

Dr. Theodore P. Brookes (St. Louis Mo.), closing discussion: In the matter of traction, where you have a rotary dislocation I see no reason for traction. It should be reduced at once by this manual method. When, as the doctor says, you have a complete anterior displacement of the third, fourth or fifth, you do not want to do much rotation, and there we use the Taylor head traction where the collar is placed upon the patient in the ordinary orthopedic head traction affair. A belt is around the operator's waist, the patient is placed over the edge of the table, and then with the patient being held there by a sturdy assistant, the operator throws his weight back against that belt. He gets immediate traction and he is able then with his hands upon the patient's head to gently manipulate one side over the other, or even stand on a stool to give him a little bit anterior pull, and then drop back into normal position. Our point is that to put those patients in bed with the traction over the head of the bed will not accomplish anything in the majority of the cases. They fight the traction, will pull out of it. It is uncomfortable. Our own experience with it (perhaps we were unfortunate) is that it has been very unsatisfactory. If we can get them with immediate traction by the Taylor method or by the retrolateral flexion and rotation of the Walton, we feel we can anticipate a better result.

Dr. F. H. Ewerhardt (St. Louis, Mo.), closing discussion: I shall take but a few moments to dwell

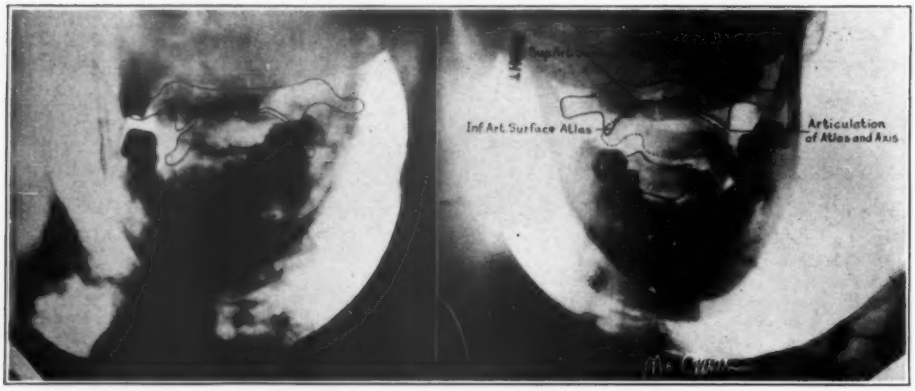

Fig. 5. The artist has lined the roentgenograms, showing the case in normal relationships after reduction on the left. On the right is seen the displacement of the atlas, over-riding the right lateral mass of the axis. On this right side, the articulation of the atlas and axis is obscured by the over-riding atlas. The left atlanto-axial articulation is clearly seen.

on the physical therapy phase of this particular case. We feel very happy about this result. We tried to reduce it without the aid of physical therapy and failed. After using proper physical therapy methods we were able to reduce. We first heated the parts. We used radiant heat and diathermy. This was done daily for three weeks. The object was to heat and then to stretch the contracted and spastic muscles. Afer that we put the patient on rhythmic traction as Dr. Brookes mentioned for a period of from twelve to fifteen minutes daily. This was the preliminary treatment which was continued for three weeks.

The physical therapy treatment was continued after the dislocation had been reduced. That consisted of heat and massage and efforts to strengthen the muscles so that they might hold the head in the proper position.

Progress in Occupational Therapy

The occupational therapy department at the East Moline State hospital, reorganized by Mrs. Forbes and Miss Grafe under the direction of Dr. C. H. Anderson, managing officer, is developing into a highly important factor in the treatment and welfare of its patients. It is becoming the outlet for a great variety of interests and offers real facilities for constructive work, not only during the hospital period of the patient, but also after return to home conditions.

It creates a new series of contacts. The patients are brought into touch with occupational therapy workers, whose whole time is spent in appealing to their practical interests, and who have not the same relation to them as the doctors or attendants or heads of industrial departments. I have known patients whose antagonistic attitude has been modified by the occupational therapy worker, who naturally has approached them in a less professional way.

The department now creates a working atmosphere; it indicates to new patients that an attempt is being made to meet the needs of the different individuals. It appeals to the new patient in such a way that it creates a spirit of hope and new interest which means much. The patient is given a chance to prove himself capable and successful and not necessarily a failure. Every type of mental case is being appealed to. The mentally deficient are taught orderly habits and ways of work which stand them in good stead and it means the substitution of good habits for bad ones.

Depressed cases are made to feel that life has still something in store for them; the maniac is shown how to direct his energy in a more constructive way; the paranoid individual is side tracked from his suspicions and delusions of persecution, and the organically ill have an aid in maintaining their dwindling intellectual faculties.

The department as it is now organized is one of the most useful agents we possess in promoting recovery and betterment. Every state hospital should have a well organized therapy department, varied to suit the individual needs of the patient. The state hospital which utilizes a well organized division of occupational therapy tends to create among its patients a spirit of hopefulness and of happiness which is largely lacking in hospitals showing an indifference to occupational therapy — (*Welfare Bulletin,* Nov. and Dec., 1931.)

PHYSICAL THERAPY IN THE TREATMENT OF ERYSIPELAS AND KINDRED SKIN INFECTIONS *

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Anatomically, the skin is composed of two constant organic parts, the cornium and epidermis. The epidermis is composed of several layers of transparent and translucent cells. There is no blood supply and very few nerves. The cornium is very vascular and well supplied with nerves and glands. In fact, the skin is so constructed as to meet the requirements of a highly specialized organ.

The skin and its functions are essential to the life of the individual. The skin is an organ, complex in structure and endowed with active and passive functions.

As a fibro elastic membrane it affords passive covering and protection to the other tissues with which it is intimately related on the one side, and receives impressions from the outer world to which it is continually exposed on the other.

The skin beautifies the human body, gives roundness to the angles and curves of the body and for this and other purposes it varies in thickness in different regions of the body. No other organ in the body has so many functions to perform and none is so continually exposed to deleterious influences.

Extensive experiments have proved external applications to be practically non-absorbent, but many times extremely irritating. On the other hand, the different bands of the spectrum penetrate the skin to varying degrees, and the amount and character of the reaction depends on the particular segment of the spectrum used.

By placing dead skin in Ringer's solution, it was found that dead and living skin so treated were penetrated practically to the same degree by ultraviolet irradiations, and this fact has made it possible for Bachem and others to carry on a series of experiments that have proved the penetration of ultraviolet light to be much more than was previously supposed.

Biologically and otherwise through penetration, absorption and fluorescence the ultraviolet ray has a profound action on the skin. The skin is suspectible to infections and may develop very severe attacks of dermatitis venenata from external irritants. Of the acute inflammatory skin lesions, the most outstanding is Erysipelas or St. Anthony's fire, and although the lesion is superficial, perhaps no condition has been more grossly, wrongly diagnosed or can boast of a wider range of therapeutics.

Erysipelas may be either endemic or epidemic. Erysipelas was frequently referred to by the ancients (Arabs, Greeks, Romans, and Chinese), but the first accurate report of an epidemic was in France, in 1750. Later, in Europe and America, in 1842 and 1843, but the first regular account of Erysipelas was published in 1597.

In tracing the history of the various diseases, we invariably stop with the age of Hypocrates. In this instance we find in his records definite references to Erysipelas. He speaks of the disease as of the skin and of its tendency to involve deeper structures.

As an illustration, let me quote what Galen interprets as a case of malignant Erysipelas. (*Genuine Works of Hypocrates, Epidemics*, Book I, Case IX, Adams, Volume I.):

"Criton in Aehases, while still on foot, and going about, was seized with a violent pain in the great toe; he took to bed the same day, had rigors and nausea, recovered his heat slightly, at night he was delirious. On the 2nd, swelling of the whole foot about the ankle, erythema, distention and swelling and small (Bullae Phyltennae). Acute fever, he became furiously deranged, alvine discharges bilious, unmixed and rather frequently, he died on the second day from commencement."

Galen farther on defines Erysipelas as follows:

"If a fluxion or congestion arises from mixture of the blood and yellow bile or from hot bile much attemated, the disorder is termed Erysipelas, which has a much greater heat than an inflammation, and a yellower aspect. If you touch or press it, blood readily disappears and again returns appearing very thin and florid but yet an Erysipelas is not so painful as an inflamma-

* Read at the Tenth Annual Meeting of the American Congress of Physical Therapy, Omaha, Nebraska, Oct. 5, 1931.

tion nor is it like any kind of inflammation accompanied with a pulsation, resistance or tension. Even sometimes it appears very moderate, especially when it is spread only about the skin without injuring the adjacent flesh as it most generally does and is then a true Erysipelas."

Richard Wisman, in 1676, speaks of Erysipelas as a hot serum generated in the blood. A hundred years later, John Ball calls Erysipelas an offspring of a bilious serum. With such a picture of cutaneous disorders, it is easy to see why everything from Ergot Poison to Herpes Zoster was diagnosed as Erysipelas.

Henly, in 1840, advanced the germ theory, but it is with the advent of the twentieth century that we have our present day picture of Erysipelas, as pathologically an acute inflammation of the skin caused by the *streptococcus* which has a marked tendency to spread through the lymphatics to the deeper structures of the body. Clinically, Erysipelas is characterized by fever, redness and swelling of the skin, moderate or extreme prostration and running a course of about fourteen days.

Erysipeloid or Diamond's Disease

Of the kindred skin infections the most outstanding is Erysipeloid; so designated by Rosenbach in 1884. The disease is caused by the bacillus of swine Erysipelas. The bacillus is very widely disseminated among fish and swine, and at least fifty per cent of healthy hogs are carriers. The human strain of the bacillus has a special affinity for the skin but causes three types of cases. A general sepsis that is more or less rare, a polyarthritis, which is rarely seen outside of Germany, and Diamond's Disease.

Diamond's Disease covers the greater percentage of cases, because the bacillus almost invariably attacks the skin only. Diamond's Disease is characterized by very slight, if any, constitutional symptoms, sharply circumscribed quadrangular, bluish-red areas, which spread irregularly and slowly and with swelling, tenderness and a constant fear on the part of the patient of impending disaster. Diamond's Disease in its milder form, runs a course of at least three weeks. There are frequent relapses and convalescence is slow. According to Klauder and Harkins, of Philadelphia, the disease is of extreme importance to industry as the lesion principally involves the hands, and because of the absolute inadequacy of either local or internal treatment of any kind.

Germany has a serum that has some therapeutic virtue, were it not for the associated serum sickness which places it rather in disfavor. Because of this serum sickness, it is not used in the United States. The foregoing authors state that efforts are being made to overcome this serum sickness, but that until this is accomplished, there is nothing that gives us any benefit in the way of treatment except rest and possibly hot applications. The prognosis under this type of therapy is three to six weeks.

Of the acute inflammations of the skin, Erysipelas and Erysipeloid are the most outstanding and from the point of therapeutics, there is no virtue in making any further classification.

In treating the skin we think of it as regards its accessibility and natural resistance to external influences. The skin being a superficial organ, topical applications have always been the sheet anchor in therapy. Hypocrates recommended diet, astringents and cold applications unless there was ulceration, otherwise he advised hydrotherapy applications to the contiguous parts only. During the subsequent centuries, treatment was varied. However, there were few changes except that later cold applications were very much tabooed. Signs and the amulets were always in evidence.

Even as late as 1875, a physician of fifty years experience, living in Alabama, writes as follows: "In cases of recurrent Erysipelas, have some green glass beads strung on a silk string, to make a necklace to which by a silk string, attach a small silk bag filled with powdered sulphur. This is to be constantly worn." He substantiates his claim by a series of case records, illustrated as follows:

"Patient — Gentleman, age 71 years. Suffered twelve years. May and June very sick, nigh unto death. Put on beads and escaped for the first year in thirteen, entirely. After five years almost completely free. String broke and put aside. Within a few hours there was a recurrence. Beads replaced and this year no outbreak save a tingling in forehead."

Advent of Surgery

In 1804, surgery entered into competition with medicinals and mystic charms and claimed much for surgery in the treatment

of Erysipelas. Surgery advocated incisions one to one and one-half inches long, through the skin down to the muscle, to be followed then by hot fomentations.

Much was also claimed for collodion applied around an Erysipelas area.

We can all remember the cranberry poultice. We have all applied Ichthyol and carbolic acid. (The latter applied to the lesion, and adjacent tissue neutralized with alcohol as soon as the epidermis turns white, will give you some benefit.) Today we are using x-ray, ultraviolet irradiations, proteins, serums, and cold magnesium sulphate and glycerine packs.

Ude and Platou have reported 472 hospitalized cases of Erysipelas. These cases were treated as follows: 151 with magnesium sulphate and glycerine packs; 113 with x-ray; 147 with ultraviolet; 12 with antitoxin; 26 with x-ray and antitoxin and 23 with ultraviolet and antitoxin. In summing up the results of this series, it was found that the ultraviolet light made a 44 per cent reduction in the mortality rate, leaving out those cases that died from other causes. The temperature returned to normal two and one-half days sooner and normal symptoms returned three or four days sooner than under magnesium sulphate and glycerine packs. These investigators came to the conclusion that the shorter rays gave the most benefit, that the burner should be relatively new and that the treatment should be intensive.

What little experience I have had has led me to draw the same conclusions regarding the benefit to be derived from the use of ultraviolet irradiations in erysipelas and erysipeloid infections of the skin. It has also been my observation that the treatment must be intensive to get the best results from that type of therapy.

With regard to erysipeloid, it has been our good fortune, if you can speak of it as such, to come in contact with the average number of cases originating in a packing plant; and our results from ordinary treatment as ordinarily instituted in local inflammatory lesions is on a par with those given by Klauder and Harkins.

We all know that the virulence of any disease varies from time to time. However, for two years now, we have used ultraviolet irradiations in the affection recognized as Diamond's Disease. So far our results have been the nearest to 100 per cent that it has ever been in my experience to witness from any therapeutic measure applied to any diseased condition.

Inasmuch as the remedy under discussion is active in the skin only, you will be disappointed in your results if you include cellulitis and all lesions in which deeper structures are involved and where a deeper sepsis is evident. This is one place where prognosis depends definitely on the accuracy of diagnosis and technic.

I have already demonstrated in the foregoing pages that anything may be proved by case records. I am letting the foregoing claims in regard to the specificity of ultraviolet radiation to stand simply as a bald statement which you can substantiate if you select your cases and apply the following technic.

Thoroughly cleanse the skin involved with soap and water, then with ether. In irradiating the skin use a distance that you not only get the benefit of the biologic rays but also the full effect of the shorter ones. Give each case all the ultraviolet exposure the skin will tolerate without too much of a fourth degree reaction. Inspect your case each day and if possible, treat each day, increasing your time of exposure. Your patient may continue his usual occupation during the course of the disease unless it is of such a nature as to cause too much trauma. Then either change to lighter work or discontinue work until better. So treated, scarcely any of our skin type of Erysipeloid cases have gone beyond ten days in making a recovery. These results have not only been very gratifying to us but have met with the most enthusiastic approval of the industrialist. The several case reports presented below are submitted in rough outline as an indication of personal experiences with the beneficial possibilities of ultraviolet irradiation in certain types of erysipelas infections.

Clinical Reports

Case 1.—Came to the office July 6, 1931, stating that two weeks previously he had injured his finger while cleaning some bullheads. He developed inflammation in his hand which had steadily become worse though he was under treatment during this

period, and at present the hand is very much swollen up to the wrist. He was very much frightened, thinking that he had a lymphangitis. I made a diagnosis of erysipeloid or Diamond's Disease infection from fish. I gave him an ultraviolet treatment on the 6th, one on the 7th. Most of the swelling disappeared. I repeated the treatment on the 8th, and at that time the condition was practically cleared up, but because of the danger of recurrence in these cases, I treated him on the 9th and 10th, making a total of 5 treatments. Completely relieved.

Case 2.—Came to the office July 31, 1931. I treated him on Friday and again on Saturday. The infection seemed to be cured. I told him to miss Sunday and report again on August 3rd. He came back with the whole hand involved. He was treated on the 4th, 5th, 6th, 7th, 8th, 9th, 10th, with apparently no improvement. On Monday, the 11th, the condition was decidedly worse with swelling of the gland under the arm, no elevation of temperature. During this period we had changed technicians and the cleansing of the skin before the treatment had been neglected. This man had been working at his job that brought him in contact with considerable oil. I had his hands thoroughly cleansed with soap and water, bathed with ether and gave him a long intense treatment on the 11th. When he came back the next day, the condition was almost unbelievably improved. He was treated on the 12th, 13th, 14th, 15th. The last 2 or 3 treatments would have been unnecessary but were given to prevent the possibility of relapse.

Case 3.—Patient came on August 11th, The treatments were followed up on the 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st. Complete recovery. In each instance I have carried the treatment 3 or 4 days longer than probably would have been necessary.

Case 4.—Patient referred to me with a diagnosis of erysipeloid in the finger. When I placed this under the light the characteristics of the erysipeloid infection were not present. I gave the treatment, however, and had the patient return the next day, on which date we incised an abscess in the cellular tissue.

Case 5.—This is the second attack this boy has had within a year. He came in on Sept. 8, was treated on the 8th, 9th, 10th, 11th, 12th, 13th. On that date it seemed as though I could dismiss the case but asked to have him report for inspection the next day. When he came in, there was a large area of inflammation which seemed to me to be quite an extensive area of involvement due to a relapse. Under the light, however, the characteristics of erysipeloid were not demonstrable. This point has been called to my attention very frequently. In erysipelas or erysipeloid infection of the skin, the redness is very much accentuated under the ultraviolet light. The line of demarcation is very distinct, while in the case of a cellulitis, the area appears very much redder under normal light than it does under the ultraviolet light. I asked Mr. W. what he had been doing and he told me he had been in a fight the night before and had hurt his hand. Again treated patient on the 14th, 15th, 16th, 17th.

Case 6.—Came in September 12th with a marked erysipeloid infection involving one finger. I treated him on the 12th, 13th, 14th, 15th. Complete recovery.

Summary

Of the acute inflammatory skin lesions, erysipelas and erysipeloid are of the most interest to us.

Both lesions are caused by bacteria. Both have a tendency to involve deeper structures. Both diseases are unresponsive to ordinary methods of treatment, particularly is this so with erysipeloid.

In the treatment of both diseases I feel that it is an established fact that ultraviolet irradiations give by far the best results.

The administration of ultraviolet light does not preclude the use of any other remedy and one or all should be used as indicated.

Discussion

Dr. Minick (Cambridge, Nebr.): How can you tell what you are going to get from the degree of reaction with the first treatment, for instance? Do you find much difference in treating a dark-complexioned person and a light one?

Dr. H. D. Holman (closing discussion): In speaking of the erysipeloid variety, there hasn't been one instance of failure since I started treating with the ultraviolet radiation. You have to take into consideration the factor of knowing the irradiation possibilities of your own lamp. It must be understood that each burner as well as each patient is an individual problem and you must guide yourself accordingly.

I have been increasing the intensity of my treatments from the time I started, and I am getting quicker results in consequence. You asked about the fourth degree reaction. If it blisters, the blister is a superficial one, and it heals very readily, and the skin is in better shape afterwards. I usually place a piece of covering over that blister on the following visit and treat the surrounding area.

The cases just cited are the ones I have treated in the last two months. The first was a man who had been out fishing and caught some bullheads. In cleaning the bullheads one of them apparently infected his finger with one of its horns. For two weeks he had been treating it in his own way and thought he had what is commonly called "blood poison." It was apparent

that he was suffering from an erysipeloid infection. His hand was markedly swollen up to the forearm. I treated him the same day. The next day the swelling had nearly disappeared and within a very short period he made an uneventful recovery.

Some of these infections require very long irradiations with the lamp in my possession. Just yesterday I gave a patient with palmar infection an air-cooled irradiation of 75 minutes continuously, at a distance of two and one-half feet from the burner. In the localized, small involvements I prefer the water-cooled unit. The treatment time is naturally shorter.

It is remarkable how helpful ultraviolet light is in differentiating the various types, helpful from a diagnostic point. Under the ultraviolet one can tell whether one deals with a case of erysipelas or some other form of infection. When you put an erysipelas under the ultraviolet light the whole area is intensified, and the line of demarcation is very distinct. Erysipeloid cases have spots coming up in a sort of rectagular form and are bluish under the ultraviolet light, and it progresses from day to day which often makes me think of a thermometer which goes up by jerks. It seems as though it jerks to a certain area and then takes in a quadrangular area. In cellulitus the coloring is apparently reduced. The angry red color fades down to about 25 per cent of its former intensity.

The consistent results obtained with ultraviolet light warrants our enthusiastic recommendation of this agent in the infections reported above. These observations are presented after two years of study and conservative analyses of results.

RADIO-ACTIVITY IN THE HUMAN AND ITS DETECTION *

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NEW YORK

About 1896 Becquerel noticed that uranium ores peculiarly affected the photographic plate. It is this same test that we make use of today for the detection of radio-active substances. No camera is used. The photographic plate or film is wrapped up in paper or even thin sheet lead. The radio-active substance is then placed upon it, and allowed to stand in the dark room for ten to twenty days. The plate is then taken out and developed. If there is any radio-activity, images develop. If there be no radio-activity, the entire plate remains blank. Becquerel also noticed that uranium or uranium salts affected the electroscope. This instrument contains an eyepiece. Within the electroscope there is a metallic bar, and at the side of it there hangs a very thin aluminum leaf. When the instrument is electrically charged the leaf and the bar receive charges of the same kind. Both the bar and the leaf are negatively charged, and therefore the leaf will be repelled from the bar. On standing the bar and the leaf gradually and very slowly lose their charges (natural leak) and the leaf comes back to its original position. This, however, takes several hours. By means of a scale within the instrument the time of collapse can be measured. A ten division drop on the scale takes about 3,000 seconds. If, however, one places into the lower chamber of a charged electroscope some radio-active substance, as Becquerel did, we find that the leaf collapses very quickly, a ten division drop in a very few seconds. The speed with which this happens depends on the strength of the radio-activity. On isolating the uranium from the uranium ore investigators found that the rock residue was about four times more radio-active than the pure isolated uranium salt. This led several investigators to the problem of isolating this powerful radio-active substance. The Curies succeeded in isolating this substance from the uranium residues, and called it radium. They found the pure radium several million times more active than uranium.

What is this mysterious radium? You all know the calcium, barium, strontium group. Radium belongs to this same group. It is a metal, just as calcium is. It forms chlorides, bromides and sulphates. The solubility of the corresponding salts is much

* Read before the New York Physical Therapy Society, New York, February, 1932.

alike. So that radium is very similar to calcium in all its properties, with one difference, that radium itself spontaneously decomposes and emits emanations continuously, while calcium and barium do not. No one can start this decomposition of radium, nor can anyone stop it. It goes on of itself, and forever. In recent years physicists have succeeded in breaking down traces of other elements, but this is beyond the boundaries of my discussion.

To give you some idea of what radium is one must discuss the very element in back of it. All elements are made up of atoms. An atom is the smallest indivisible particle of any substance. All atoms are made up of protons and electrons. Hydrogen for example has one proton with one positive charge and it has one electron, which revolves around the proton. It is the simplest atom recognized by science. Let us examine the helium atom, with atomic weight of 4. It has a nucleus of 4 protons. Two of the protons are free, having two positive charges. The other two protons are combined with an equal number of negative charges. The nucleus having two plus charges in excess, there are two electrons revolving in an orbit around the nucleus. We can consider each atom as a tiny planetary system. Just as stars and planets revolve in imaginary orbits, just so do the electrons revolve around the nucleus. In sodium there are 23 protons, 11 of which are free; 12 of the protons are united in one group with equal negative charges; the 11 free protons carry 11 plus charges. Therefore 11 electrons are revolving in orbits around the nucleus. There are 2 electrons in the first orbit, 8 in the second, and 1 in the third. Then carbon with an atomic weight of 12 has six protons with six free plus charges, consequently there are six electrons revolving around the nucleus, two electrons in the first orbit and 4 in the second. In regard to the radium atom, its atomic weight is 226. The atomic number is 88 and it has 88 revolving electrons in their respective orbits.

Rutherford in 1903, explained that the spontaneous decomposition of radium is due to the fact that it gives off *alpha*, *beta*, and *gamma* rays. Let us describe the nature of the emitted rays of radium. If a radio-active substance is placed within an electric field, the alpha particles are deflected in their path toward the negative pole. Since they are attracted toward the negative pole, the alpha particles must be positively charged. The beta particles are deflected toward the positive pole. This shows that they are negatively charged. The gamma rays are not affected by the electrical field, hence are not charged electrically. The alpha rays have been proved to be helium gas atoms with two positive charges. The beta particle is a negative unit of electricity, with mass of 1/1800 of the H atom. The gamma rays have not particles, but are waves in ether similar to x-rays. The alpha particles weigh 4 as compared to the hydrogen atom, weighing 1. The beta particles are very light, about 1/1800 of the H atom. The gamma rays have no weight. The wavelength of the gamma rays is 10^{-8} as compared to light waves of 10^{-5} and wireless waves of 10^{5}. The speed with which the alpha rays are thrown off is about one-tenth the speed of light. The speed with which the beta rays are thrown off is approximately the same speed as light.

Penetration Power: The alpha particles are stopped even by paper. The beta particles penetrate paper, and aluminum foil 0.1 mm. thick. The gamma rays will penetrate quite thick layers of material.

When the relationship of the various members of the radium group is considered one observes that uranium is the mother substance. As the uranium atom throws off an alpha particle it becomes uranium X_1, a new element. The latter throws off a beta particle and becomes uranium X_2. Next it loses another beta particle and becomes uranium II; it then throws off an alpha particle and becomes ionium. The latter in turn throws off another alpha particle and radium results. Radium is a solid metal with atomic weight of 226. Radium now in turn loses another alpha particle and radon, a gas of 226 atomic weight, results. This is the gas also known as emanation. Radon is also radio-active. It also spontaneously decomposes. By the loss of an alpha particle the radon gas changes to a solid again, radium A. Similar and further decomposition yields in succession radium B, C, C^1, D, E, F, and finally lead is obtained.

The cases of which I am about to call your attention are those which, no doubt,

you have recently read a great deal: The watch dial painters in New Jersey. These girls used a paint made up of zinc sulphide which contained but the merest traces of radium. They used little brushes to apply it to the watch dials. They were wont to point these brushes between their lips. In this way they absorbed small traces of radium daily. After three to four years the radium poisoning symptoms develop, and the patient dies in a few years. I place before you a case containing some of the bones of one of the watch dial painters. It contains the femur, the tibia, two vertebrae, the bones of the hand, and a piece of a jaw bone, the only piece of jaw bone found at autopsy. The rest of the jaw bone came out in pieces during life. In these little vials we have ash of liver, lung, and brain. Even the ash of the soft tissue is radio-active. I used the same photographic method to detect radio-activity in these bones as I described above. You can see in these pictures how the radium rays from these bones affect the photographic plate. These are what we might call auto-photographs, made by simply putting the bones on the photographic plate; the gamma ray will even go through lead and affect the plate so that when you develop it you get these images.

I have some interesting data as to the amounts. Very few people realize how small an amount of radium will do harm. This girl has between 40 and 50 micrograms of radium in her entire skeleton. If 50 micrograms are in the entire skeleton, one-quarter ounce of bone will contain 1/50,000 milligram, or one-three millionth of a grain of radium. These amounts emphasize how little radium is fatal. I calculated just for interest's sake how many atoms of radium there are in one-quarter ounce of bone. There are present 2.5×10^{13} atoms of radium, and approximately 1.5×10^{22} molecules of bone substance. Therefore the ratio of radium atoms to bone molecules is about 1 atom radium to 600 million molecules of bone.

The one-half life of radium is 1600 years, that is, if I took a piece of radium today and came back in 1600 years, I would have one-half the radium left. If I came back in 1600 years after that, I would have a quarter left. That is what we mean by one-half life. Radium gives off in decomposing to lead 5 alpha, and 4 beta particles, so that in each second that little piece of bone gives off 1100 alpha and 800 beta particles.

There are a lot of interesting facts about radium. There is a great deal of energy in it, and here are some of the effects of radium: It will effect photographic plates; it will ionize substances; it will ionize air; when radium bombards zinc sulphide it produces luminescence. When it decomposes heat, energy is evolved. Radium emanations will induce chemical actions and colloidal changes. It will produce physiological actions. It will produce mechanical actions, and lastly, it will destroy atoms.

So far as energy is concerned, the following figures are interesting. Perhaps you know that one gram of carbon when it burns gives off 8000 calories. One gram of radium when completely decomposing to lead gives off two billion calories. The only trouble is that it takes too long, 1600 years for half life. It has been calculated that the energy in one pound of uranium salt is enough to drive one of our big ocean steamers across the Atlantic. We can buy a pound for about $4.50. It would, however, take five billion years for the trip. If we could accelerate the decomposition of radio-active substances, and if we could harness the energy so evolved, the world would have a most powerful source of energy.

The last series of cases which have come to the attention of the public are the radium water drinkers. I have here some of the bones of one of these individuals who drank radium water. I have not finished with the quantitative determination of the actual amount of radium in these bones and soft tissues, but I have some preliminary data. I took a composite sample of this man's bones, and determined the amount of radium present by the emanation method. The results indicated that there was present in the bone of this man 22.5 micrograms of radium per kilo of bone. This is even more radium than was found in the bones of the watch dial painter. The soft tissues, however, contained much less radium than the soft tissues of the watch dial painter.

Some interesting information may be obtained on looking over a chart on radio-active waters from some well known spas.

The units used in the following chart are the microgram and the machet. The latter is the amount of emanation that is equivalent to 10^{-3} electrostatic units. It is one three billionth of a Curie unit. The Curie unit is the total emanation which is present at equilibrium with one gram of radium. This unit is extremely small.

Emanation contents of a few well known waters:

Waters	Emanation Present in Machet Units Per Liter	Emanation Calculated to Micrograms Per Liter	In Equilibrium With Micrograms of Radium
Oberschlema	3,000	6×10^{-6}	1.2
Joachimstal	2,000	4×10^{-6}	0.8
Brambach	2,000	4×10^{-6}	0.8
Ischia	400	8×10^{-7}	0.08
Gastein	150	3×10^{-7}	0.06
Aix-les-Bains	50	1×10^{-7}	0.02
Karlsbad	30	6×10^{-8}	0.012
Synthetic water*	90,000	1.8×10^{-4}	36.0

* Amounts calculated from unofficial reports of the radium content of the water consumed by Mr. B.

I should like to call your attention to the following significant points in the chart:

1. That the synthetic water which has killed Mr. B. is very much more powerful in emanation than the natural waters.

2. Although the chart shows the radium content present per liter when in equilibrium with its emanation, the natural waters are said to contain no radium, but only emanation.

3. The synthetic water actually contained 36 micrograms of radium salt per liter.

Obviously the radium content of the water produced the death of Mr. B.

Conclusion

Radium should under no circumstances be given internally in any form, for medication, for rejuvenation, or for whatnot. As to waters containing no radium salts, but containing radon (emanation) we know very little at present as to the possible effect over years of usage. I shall only advise abstaining from them until we have enough experimental evidence to give a definite opinion. In external treatment of cancer with radium needles, no radium gets into the circulation, and therefore the remarks made in this paper are not applicable.

(Joint discussion of this paper will be found at end of Dr. Flinn's article).

DANGERS OF INTERNAL RADIUM THERAPY *

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NEW YORK

My attitude in 1924-25 when the first cases of industrial radium poisoning were called to my attention was one of conservatism. Probably many of you have the same reactions as regards the danger of internal radium therapy. This attitude was fostered by some of the theories advanced by the early investigators. Stories that the human bodies are luminous at night still exist. I have probably examined more radium cases than any one else and I have yet to see my first luminous body, nor has any intensive questioning of the families or patients themselves revealed such a phenomenon. Furthermore, it is not good physics. Any luminousity disappears after a good hot bath and scrubbing, for it is due to the fine dust that has settled on the body or derived from the hands.

* Read before the New York Physical Therapy Society, New York, February, 1932.

Furthermore, I was unable to agree with Martland's early suggestions, (which he no longer holds), that the minute particles of luminous material that got into the oral cavity, passing over the teeth with a few specks, possibly, temporarily lodging in cavities was responsible for jaw necrosis commonly present in the early cases. Animal experiments had convinced me that while radium sulphate, the form in which radium was present in the paint, was practically insoluble according to the literature, a very small percentage of the sulphate was dissolved in the body fluids and carried around in the blood stream until it was either deposited in the bones or eliminated. Recent work has shown that out of every gram of radium sulphate 0.14 milligrams are dissolved out in 100 cc. of water and that the radium sulphate itself tends to break down either in the air or in water.

Why then if radium was absorbed by the body and a certain percentage deposited in the skeleton because of its chemical kin to calcium, had we had no cases reported by the medical profession in instances where radium salts had either been injected or ingested by mouth? Attempts have been made to explain this by saying that soluble salts are used for therapeutic purposes. However, many advocates of internal therapy used radium sulphate with the hope that it would remain in the body for a longer period than the chloride or bromide salts. Stevens has tried to explain it by saying that "In case of dial painters the fluorescent menstrum, pyrosulphide of zinc, probably sensitized the tissues to the action of radio-active elements." One reviews the literature in vain to find any report of electroscopic tests of the body being made when radium therapy was practiced, so that when we read of the salt being eliminated it simply means that the amount eliminated in the urine and stools was too minute to detect or to mean anything and no consideration was given to the deposits of radio-active material in the bones. The statement can be made without fear of contradiction that no matter in what form radium is absorbed by the body that in time, if not eliminated, it will be found distributed more or less evenly over the entire skeleton. Advocates of this method of treatment stress the fact that the bone and bone marrow have a special affinity for radium and that they depend on that for beneficial effects.

As my studies progressed and my observations widened, I began to realize why radium poisoning cases as the result of therapeutic treatment had not been reported. With the exception of one or two cases out of the number in which I have assisted in the diagnosis, the doctor or dentist treating them attributed the trouble to some other cause than their previous industrial exposure. It was only by chance that it was brought out that they had worked in a clock factory. In practically every case no progress had been made in treating the pathologic condition. This is exactly what happened in the medical cases which have recently received so much publicity. It was only after they had been under medical care for some time that it was discovered that they had been taking a preparation called "Radithor." Even then the medical men did not believe that they had actually ingested radio-active material because of so many fake preparations on the market. An electroscopic test together with the clinical picture and history gave the correct diagnosis. This preparation contained two micrograms of radio-active material in solution in triple distilled water which was supposed to be poured into a glass of water and drunk. I had testified a year before I saw Byers' case, in the Federal suit against the Bailey Laboratories that this preparation was dangerous and might produce the same clinical picture as was seen in the industrial cases of radium poisoning. I did not expect to get such a complete confirmation of my testimony as was shown in the two cases a year later.

Insidious Nature of Internal Radium Therapy

One of the dangers of internal radium therapy is the length of time it often takes before recognizable symptoms appear. By that I mean that when the patient goes to the doctor for treatment, it is generally too late for saving his or her life. These symptoms are frequently a loose tooth with pus, or indefinite pain in the shoulder, spine or pelvic area, or pains in the foot. Radiographs may show very small areas of decalcification. The industrial cases which are now appearing are those of employees who had worked previously to 1925, which emphasizes the insidiousness of the poison. One girl whom I examined a year ago had not worked since 1918, bore children, and remained in apparent good health until three years previous to my examination. Her trouble at that time was a spontaneous fracture of the femur which apparently healed although recent radiographs show that there has been very little calcium deposit. Two years later she had another spontaneous fracture, about four inches above the first one and when I examined her a year later she was still in a plaster cast with no union. Up to the time of my examination radium had not been taken into consideration. At the present moment she is still in a cast but without any indication of new bone being formed. She looks perfectly well with perhaps a slight anemia which ordinarily would have no significance. In the past few weeks it was discovered that the teeth in the lower jaw are loose and ready to fall out, and this girl still has a radio-activity of around ten micrograms. I have had several cases where the symptoms did not appear for almost as long a time.

I have examined twelve persons who have

taken "Radithor" and have found all but three to be radioactive and one of the three is just on the borderline. The quantity taken varied from 160 bottles to several thousand. At the time of my examination they had not drunk any of the product for several years. Schlundt and Barker examining some patients of an ardent advocate of internal radium therapy, found that out of ten cases receiving intravenous injections and oral medication in total amounts of from 207 to 1445 micrograms, six were positive and one showed a mere trace. I am confident that if we were privileged to examine a large number of patients who had received this treatment we would find that many of them would show the presence of radioactive material. It should be borne in mind in this connection that not every dial painter who had ingested the paint had been found to be radioactive. Some either possessed better eliminating powers than others of their fellow workers or by chance the body did not absorb it. The same condition probably would be found to exist in the therapeutic cases. Then, too, it must be remembered that some patients received only a small number of injections, and much radioactivity would not be expected in these cases.

Proescher writes that, "When soluble radium salts are injected intravenously the radium is carried through the body and deposited in the form of carbonates and sulphates. The radium is to a small extent excreted in the urine and feces, the greater portion, however, being deposited in the bone marrow. The organism is therefore rendered not only passively, but actively radioactive for a considerable time and, of greater importance, the action is constant. In other words the body becomes a vital emanatorium due to the deposits of radium salts."

Levi and Thomas write, "The action of thorium is perhaps due to an electric fixation of radioactive substances by the bones of the spine, or to the elimination of uric acid, which, according to one investigator, follows the absorption of radioactive substances. Field, so widely quoted in the advertisement of radioactive products says, "The physiological manifestation of radium naturally centers around its effect on metabolism and the blood. There are evidences of a selective influence as regards radium such as the affinity that attracts it to the bone marrow, where it seems to increase markedly the red count."

Methods for Detecting Radium Absorption

One of the difficulties that beset the physician in diagnosing a case in which radium has been used without his knowledge, is that there is no characteristic blood picture produced by radium until near the end. This has been shown in our human cases as well as in animal experiments. Dr. Florence Sabin has confirmed these observations in a report of her experiments which she is publishing shortly. Unless there is some indication of bone trouble radiographs are not taken, which might, to one familiar with the picture, suggest the hazard. The only absolute way in which a correct diagnosis can be made is by the use of the electroscope, and unfortunately the doctor does not include such an instrument in his equipment nor is he as a rule qualified to make such a test. Also, unless his patient, when the history of the case is being taken, mentioned a radium treatment, there would be no reason why such a test should be suggested. A reliable test requires about three hours if the determination of expired air is included. The presence of small amounts of radioactive substance can be determined by the expired-air test better than by the *Gamma* Ray test, but it is not quantitative, in my opinion.

One naturally inquires, what is the safe amount of radioactivity that the body can have without fear of ill effects? At one time I was inclined to agree with Martland that ten micrograms is the upper limit. My experience is tending to make me put it at a much lower figure. It certainly would not be above one microgram, and I arrive at this conclusion in this manner: The first cases which ended fatally within a couple of years or so contained from 30 to 180 micrograms of radioactive material. Then came another series of cases which took longer to show up and which have suffered from bone conditions other than jaw necrosis. It is in this series that most of the cases of sarcoma have appeared. These cases are from 10 to 30 micrograms. In cases around 15 micrograms we have in time an extensive bone destruction taking place all over the skeleton, and now recently I have had cases where the activity is between two and ten micrograms. A case with approximately two to three micrograms shows several spontaneous fractures of the

ribs and bone destruction around the pelvic areas; several cases showing an activity of one to two micrograms are beginning to complain of pains in the bones and tooth trouble. Of course many of these cases at one time contained more radium than is at present indicated. I am convinced that it is a matter of exposure and time. The smaller amount present the longer time will it be before pathologic conditions appear, and of course, a great deal depends on the general health and nutritional condition of the person affected. No one at this time is qualified to state the amount safe for the human body. One cannot but feel that there have been deaths resulting from therapeutic treatment which have been attributed to other causes than the affects of radium such as we have found to be the case among our industrial workers.

Just how radioactive substances act when present in the body is as yet unknown. Von Noorden and others have advanced the theory that it is an autolytic, catalytic or electrical force exerted on the individual cell. Others have laid its beneficial effect to the massaging action that comes from the physical impact of the alpha particle. Stimulation and ionization play their part followed by a destructive action. Radium is both a diuretic and laxative with certain doses.

I am perfectly willing to agree with the claims as to where the radium is deposited and its action on the bone marrow, and in some cases its actions on deposits in the tissues. They fit in and parallel the early clinical history of our industrial poisoning cases; I take it for granted, however, that no responsible medical man will support the claims advanced by the manufacturer of such compounds as "Radithor" or many other radioactive waters. Bailey's Laboratories claim beneficial effects for over 100 different conditions. It cured constipation and diarrhea equally well.

Action of Internal Radium

When radium is deposited in the bone its action may be both stimulating and destructive, the latter action finally overcoming the stimulating effect. The fact one may consider them to be the same thing as the stimulating action means a speeding up of the metabolism of the cell until it is worn out in the same way that a machine can be injured if constantly speeded up beyond a certain limit. In the case of the bone both a destructive and stimulating action may be seen in the same areas. Two osteoblastic cells are finally killed or injured, and the feeling is growing that even if all the radium were eliminated, the power for bone regeneration is gone and a gradual absorption of devitalized bone continues. It may be that I am too pessimistic in the matter.

The bone marrow is another example. At first there is a stimulation indicated by an increase in the blood cells. The same action is observed in the lymph nodes. It is this polycythemia, and an increase in white cells that masks the pathologic effects and misleads one not familiar with the action of radium. I am of the opinion that the reason the white cells remain up so long is due to the effect of an infection resulting from destroyed tissue. As times goes on anisocytosis, poilkilocytosis and nucleated red cells begin to make their appearance in the blood stream. The hemoglobin, red, and white cells begin to fall and the color index is one plus. If the patient does not succumb to general septicemia too early the bone marrow presents a picture of aplastic anemia, otherwise a hyperactive bone marrow is seen. A histological examination of the bone marrow shows a general trend toward the more primitive cells. In two of Dr. Sabin's rabbits, tumors occurred at the site of the spontaneous fracture. The lymph nodes become hypoplastic.

Because of this general trend in the blood picture, the first impression is that of improvement in cases of anemia which may continue for some time but if the patient survives long enough and the radioactive material has not been completely eliminated one can predict what the final picture will be. As I have tried to emphasize it is simply a matter of time and the quantity present. It is my feeling that it is almost criminal to use radium injections in cases of pernicious anemia.

Radium does act on deposits in the tissues. Its action on calcium deposits cannot be doubted. Whether this is a direct action or due to a stimulation of the gland controlling calcium metabolism is perhaps as yet undetermined. I personally have not observed its action on uric acid deposits. The action of radium on calcium is demonstrated as follows:

(1) Radiographs of all cases of radium poisoning show areas of decalcification. This is checked at autopsy by histological exami-

nation of the affected bone. This action is similar to the wearing down of a stone by grains of sand. Fragmentation, absorption and finally replacement of the calcium by a fibroid process is found. It is probably this action that is responsible for the spontaneous fractures that we get from time to time.

(2) Two patients who have come under my observation had been taking "Radithor" and had been suffering from a calcification of the joints. The process has either shown a marked improvement in limitation of movement or the deposition has stopped.

(3) While assisting in the treatment of a case of myositis ossificans progressive, I was called upon to administer radium internally. The patient was kept on a negative calcium balance for some weeks, and the daily rate of calcium excretion determined. After the administration of radium this rate showed an increase in the calcium elimination. A radiograph taken a year after the radium injections began, shows that the process had been at least temporarily stopped and an improvement in the limitation of movement, even though it was slight.

This is probably what happens in certain types of arthritic and rheumatic cases. Unless one can control the radium deposit, however, the decalcification of the bone may continue and some of the same symptoms which occur in the industrial cases may show up. We feel that where radium is being used internally frequent electroscopic tests should be made to determine how much is being retained by the body and not to increase the deposit by additional injections.

Ignorance as to the effect of the different rays frequently surprises me. It is often said that in internal therapy one escapes the effects of the harmful "*Gamma* rays" and is benefited by the harmless "*Alpha* rays." The *Alpha* ray is the most powerful force known to man and the constant bombardment of the large number of these rays set free, 37 billion per second per gram, cannot but injure tissue in time. Fortunately, because of their large size and velocity they cannot penetrate very far into the tissue — only a matter of millimeters — which probably accounts for the reason that we find most of the damage done is the immediate site of the deposit. Why anyone should talk about the HARMLESS Alpha particle is beyond my comprehension, if they know anything about the subject at all.

There is no need for me to go into all the pathologic findings of radium poisoning as they have been described in the literature, but I would emphasize the fact that internal radium treatment is fraught with the same danger as appears in the cases of the dial painters. Fortunately we know how much we are injecting by frequent electroscopic tests, control the amount deposited and can stop the injection at the first indication of retention.

Value of Radium Emanation

I am constantly being asked if I consider emanations or radon as present in Spas waters or artificially activated waters to be dangerous. My answer has been that up to date there is no evidence that the small amounts present have ever produced any ill-effects. Most of the jars and bars do not contain enough radioactive material to present a hazard, but just enough to prevent action by the Pure Food and Drug Division. One should differentiate between radium in solution and radon which is a gas and obeys all such laws.

Until very recently, I have been unable to make satisfactory tests on emanations so that my mind might be at rest on certain questions. In the last couple of weeks there has been placed at my disposal an apparatus capable of producing 8000 Mache units in a liter of water per day. The emanations are drawn from a radium precipitate and not from a solution so that there is no danger of radium salts themselves getting into the water. I have experimented on myself to see how long these emanations could be detected in the expired air after drinking a glass of water which was charged with the gas to the extent of 10 to 13 thousand Mache units per liter of water. Ten minutes after drinking the water, my expired air was found to be very radioactive. Twenty minutes later another test showed that on the average 82.5 per cent of the emanation present 10 minutes after drinking the water had disappeared. An hour and a half after drinking the water 97.2 per cent has disappeared in the expired air. In five hours the breath was negative. No tests were made on the urine but other investigators have reported that the urine which in the first few days showed no radioactivity except shortly after the introduction, gradually attained a constant radioactivity. Sönntag reports that a colleague of his who took the "Cure" at Spa Bad Brambach was

able to detect radioactivity in his urine 14 days after his return home.

Falta has a feeling that the absorbed radon has an affinity for the lipoids, while Bouchard and Curie suggest the kidney, lungs and liver. Regardless of what tissue attracts it most, Cremieu has demonstrated that the elimination is mainly through the lungs and kidney while Lazarus suggests that there may be some elimination through the skin. With all of the data in mind one feels justified in saying that there is only a *possible* but not *probable* danger from drinking radioactive waters under proper supervision. The chief danger lies in the deposition of active decay products. It has been estimated by a physicist connected with the radium industry that if the human body were a closed system in which there was no elimination whatever and a person ingested 8000 Mache units daily there would be present at the end of a year an active deposit which would be equivalent to one microgram of radium. This is of course fantastic as my experiments on expired air show. I feel that in the normal processes of the body the amount present at the end of a year would be nearer 0.01 microgram than 1. I have been promised the pleasure of examining a group of persons who have been ingesting approximately 8000 units for over a year. While I have completed this series of examinations I will be in a better position to answer this question positively.

Action of Radon

Bouchard, Curie and Balthazard indicate that radon has a mild toxicity and this observation is confirmed to some extent by the history of the reactions of persons taking the "Cure" at the Spas. They have shown that the radon given off by one gram of radium bromide will kill mice in two days. The cases of carcinoma of the lungs among the miners of Schneesberg, Saxony and Joachimsthal, Bohemia, working in an atmosphere that is slightly radioactive is interesting. It has been suggested that although only between 50 and 70 Mache units are present in the air it may result in tumors after 20 to 30 years exposure. But these cases are not definite as the ore contains arsenic and cobalt, either of which it is said can be an etiological agent of cancer. If emanations alone will cause cancer of the lung it seems strange that we have had no case as far as I know reported. Many of our radium workers both in this country and abroad have labored for many years in an atmosphere more active than that of the mines. The atmosphere of the Spas are in some cases are far more active and it may be that a combination of the dust and emanations is the answer.

The decay of active deposit is fairly rapid. The Alpha activity decreases 47 per cent in 10 minutes, but the gamma activity only 3.4 per cent. After that the decay is slower, but at the end of three hours only 1.8 per cent of the Alpha and 3.1 per cent of the gamma activity remains. The decay of the activity of radium emanation when separated from radium is 16.5 per cent the first day and its half period 3.85 days. At the end of 30 days only 0.45 per cent remains.

The solubility of emanation in blood serum is a co-efficient of 0.168 at 37° C. which is slightly higher than distilled water; and for red corpuscles 0.298 in a physiological saline solution. The co-efficient of circulating blood is somewhere between 0.29 and 0.32 depending on the number of red cell present. One of the most interesting properties of radon is that it creates an induced radioactivity by attaching itself to bodies present. This induced radioactivity is temporary and is tied up with the products of decomposition of radon on the exposed surface.

Summary

If one wants to use radium internally it would seem that radon is the most logical and safest method. Radium is a useful tool in the hands of the trained medical man but should not be turned loose on the public by the many quack preparations. It should only be administered by properly trained men and the patient should be under the observation of the doctor during the period of treatment. The advantage of radon is that the treatment can be stopped at any time that ill-effects are noted. When radium in solution is injected, this is impossible due to the tendency to become more or less permanently deposited in the skeleton. One feels that now is a very opportune time to come to some decision as to the good or ill effect of Radon and tests should be carried out scientifically to determine the truth similar to those carried on by Dr. Monnery on chronic rheumatism. If Radon is beneficial the medical profession should have reliable data on which to base their opinion and what type of cases should be treated. If it is not beneficial even if not

definitely harmful we also should know that, so that we will be in a position to assist the Federal authorities in their attempts to protect the public against dangerous and fake preparations. It is a duty that we owe to the public.

Discussion

(Papers of Drs. Flinn and Gettler)

Dr. Jacob Gutman: As an internist, I ask myself first, if radium *is* a remedy, then in what conditions, and is its use justifiable? And second, if its use is justified, what are its limitations and our expectations from it considered from the practical viewpoint of an internist.

I first became acquainted with radium some 20 years ago when connected with Prof. Van Noorden at the time when his investigations with radium were begun. Since then I have had the privilege of studying its progress, acquainting myself with various preparations and using differently devised apparatus with varying results. There is no doubt that the study of radium is very fascinating and that most interesting facts have been brought out with regard to physical, biological and chemical nature of the element. There is also no doubt that it has certain value in internal medicine.

Radium has been carefully studied in the United States. I might admit that I have also been doing some experimental work upon myself, along the lines which Dr. Flinn has lately undertaken upon himself. I have also been using the same apparatus with which he is experimenting for almost 2 years, and have been drinking the radiatized water. I still do not see any bad effects of it. In fact, everybody asks how is it that I am looking so well.

The point is, radium like everything else in medicine has its value, its limitations and dangers, provided we know how to use it, where to apply it and to what extent it may be very useful and least dangerous. Externally its application has long ago been proven to be invaluable; that is not to be denied. But is it valuable as an internal remedy is the question frequently discussed. There is still a great deal left for experimentation, and as Dr. Flinn says, we know as yet very little about its clinical uses; we have not sufficient clinical experience to warrant a decision. Some clinicians will report satisfactory results with radium waters, and others not.

But the important question is, "Is its use dangerous"? This is a point I should like to discuss. Two and a half or three years ago I had the courage of publishing a warning in the *New York Times* because of various articles that appeared at that time in several newspapers regarding radium, and I called attention to the fact that radium if given internally in solution is a dangerous remedy. I am surprised to see that even now, in the "New and Non-Official Remedies" of the American Medical Association, that in spite of the number of deaths clearly associated with the use of radium solutions, the intravenous use of radium in solution is still recommended. To my mind there is no justification for it whatsoever. Solutions of radium are not solutions of emanations, for emanation is not radium. It is radium minus the alpha rays or helium particle, as was beautifully demonstrated here by Dr. Gettler with different physical and chemical properties. The alpha rays given off by emanation are perhaps not the same as the alpha rays given off by radium, and solutions of emanations are not as dangerous and do not remain in the body after 4 days as do solutions of radium element.

Dr. Gettler has called to your attention that the life of radium emanation is only 4 days; that is true. If I drink emanation water tonight and if you would test me for radioactivity tomorrow, you would find in my system a certain percentage of the emanation imbibed, but after 4 days there would be none. Of course, where the patient imbibes for years strongly saturated solutions of radium, as in the death case recently published, that is a different story. The same will happen with anything else which one goes on taking to excess. Keep on administering digitalis or strychnine or any other drug continually, and you know what will happen. It is not good reason to condemn radium and claim it is a crime to use it, because of deaths under certain circumstances. This form of reasoning is absolutely ridiculous to my mind. I may state that during the past summer I was afforded the opportunity of doing some clinical investigation with the apparatus Dr. Flinn is using, and I am satisfied that the use of radium emanations in certain types of cases as in uric acid conditions, for instance, is beneficial. The only thing I may state here is that it must be applied in appropriate cases and need cause no worry or fear for the safety of the patient, if emanations only are used.

Dr. Heinrich Wolf: I was the first one in America who used emanations for treatment, and I suppose I was the first to give it up, and I gave it up because I could not make any real statement to my patients about it. It is a rather unpleasant thing to tell the patient to take emanation water for six months or a year, if you cannot tell him that it is going to help him. The reports that we got were rather misleading. I started with emanation treatment on the report of Professor His, and later on, when I followed it up, I found out that he had hardly any radium-active substance in the room. Obviously the results must have been mostly suggestive. We know that many of these rheumatic conditions change, and therefore it is very easy to attribute the improvement to treatment. It is a *post hoc propter hoc.* My experiences are very unsatisfactory. The unfortunate part with all those people who recommend radium water is that they cannot give us any real physiological basis for its use. In which cases should we use it? They say for uric acid diathesis. We have no proofs. Besides, these cases are not frequent. There are just as many papers written against as for it. So long as they cannot tell us definitely in which case a result is likely to be obtained, it is useless to try it. Dr. Gutman spoke of radium emanation not being dangerous. Of course, it is a different thing to use radium in solution. Some of the speakers will contradict Dr. Gutman when he says that alpha particles thrown off from one element are different from those coming from another. They do not have any labels. They are just alpha particles. To

say that radium emanation does not do any harm is probably not without our knowledge as yet.

Dr. Frederick B. Flinn (closing the discussion): I would like to say that the synthetic water mentioned by Dr. Gettler is not radium water in the common use of the expression. I had some of the bottles sent to me for examination; it is radium and mesothorium chlorides in solution in distilled water. It is quite different from Spa waters, which are supposed to contain emanations and not radium in solution.

Dr. Alexander O. Gettler (closing the discussion): I shall answer Dr. Flinn first. I myself do not know what Mr. B. drank. I have simply taken unofficial reports and statements that have been printed.

In answer to Dr. Gutman: Helium particles, or alpha particles, are exactly the same, whether they come from uranium, or radium A, or B, or any radioactive substance. The only difference is one of speed. Dr. Gutman also must not forget that radium giving off an alpha particle changes to radon (emanation) and the radon (emanation) gives off an alpha particle and changes to radium A. Radon itself is radioactive and later on this gas radon changes into a solid, radium A, which is radioactive. Therefore, if a man drinks emanations, some of these emanations change to radium A, and to B, and to C, and these deposit in the bones. I can say nothing about radium emanation effect. Future experiments will determine its action. About the effect of radium there is no question. We have evidence in the cases cited.

Our Chairman also mentioned the fact that the physicians who tell us to use radioactive waters for various conditions do not know why, and what the effect is. There is no chemical effect; there is no real physiological effect. It is simply a bombardment of the tissues by the rays. Such bombardment irritates and any irritation temporarily increases circulation, and perhaps metabolism, and so the patient temporarily feels better, but if this bombardment is kept up very grave and fatal results ensue.

THE EFFECT OF ULTRAVIOLET LIGHT IN CUTANEOUS CONDITIONS *

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A great deal has been written on the subject of heliotherapy in recent years. Leaving aside entirely the booklets, which periodically come through the mail from various manufacturers of equipment, which on the whole are decidedly optimistic, a correct evaluation of the real worth of ultraviolet light is difficult to judge from the literature. There seems to be a great deal of confusion among physicians as to the indications for and results to be expected from the use of ultraviolet light in skin conditions. At one extreme is the viewpoint[1] . . . that "leaving out angioma serpiginosum, which is a rare disease and alopecia areata, in which it has some value, the ultraviolet ray does nothing that cannot be as well or better done in some other way." A more optimistic communication[2] states that "the therapeutic value of ultraviolet is appreciated more and more." This author comments that he not only feels that ultraviolet radiation is curative in many cases of acne, psoriasis and eczema but advocates its use as a prophylactic measure in these and other diseases. He suggests "that ultraviolet exposures will protect against other infective diseases like sycosis, trichophytia and eczema marginatum, which are very stubborn against any treatment methods, but may be easily prevented by prophylaxis."

Such widely divergent viewpoints are hard to reconcile. A question which is of paramount importance is whether ultraviolet radiation justifies its present wide use in dermatological conditions. Certainly as with other modalities and physical agents, e. g. the x-rays, a feeling of intense optimism that the agent is a cure for everything is likely to be followed by skepticism and doubt as to its efficacy in any condition. Later a truer evaluation of the modality should result in its application to only those conditions in which it has proven its worth.

It is not the purpose of this paper to discuss the physiology or the physics of ultraviolet light. These subjects have been effectively covered by other speakers. I propose to limit my discussion to a practical consid-

* Read before the New York Physical Therapy Society, February 25, 1931.

eration of its worth in dermatological practice gained from clinical experience.

Acne — While everyone is agreed that ultraviolet radiation is inferior to the x-rays in the treatment of acne, its use is sometimes indicated:

(1) Where the patient is a child before the age of puberty, x-rays are contraindicated.

(2) X-rays may not be available to treat the patient or if available there is no one with sufficient training to use the equipment therapeutically.

(3) A small percentage of acne patients are not cured by means of x-rays. After a certain limit is reached, one is forced to discontinue its use. In these patients ultraviolet light may be helpful.

(4) Where a patient shows a hypersensitivity to a test dose of x-rays one is hardly justified in proceeding further with this modality.

When for the above or other reasons, one is forced to adopt other therapeutic measures than the use of x-rays, heliotherapy may be undertaken. Frequently, patients state that their acne is much improved during the summer when they are out of doors and have been sunburned repeatedly. Some of this improvement may be due to more favorable hygienic surroundings, fresh air, exercise, etc. When one treats acne by means of the application of ultraviolet radiation, the best results are obtained when the affected skin is given erythema exposures resulting in brisk reactions, followed by peeling of the superficial epidermis. Therapeutic response is better when the patient is also given topical treatment such as the well known lotio alba in conjunction. As can be imagined the patient's skin is in a state of constant exfoliation and is dry and parched and is distinctly erythematous for several days after each lamp treatment. Such treatment is drastic and is not feasible in many instances. Young working girls especially are fearful of losing their positions and others refuse to tolerate it. However, unless the treatment is pursued vigorously, little therapeutic help need be expected.

No matter what topical applications or external therapy is given, diet, attention to the gastro intestinal tract, elimination of infective foci, improvement of general health and attention to personal hygiene, should be part of the treatment.

Psoriasis—In a disease so prone to recurrence as psoriasis, one's therapeutic resources are frequently taxed. As a rule the eruption responds to several fractional x-ray treatments. A certain danger exists however, in the chronic psoriatic who frequently changes his physician and who receives x-rays from each new consultant. It appears to the speaker, that x-rays should be used with decided caution in this disease. There is no question but that ultraviolet light therapy is helpful in many cases. Many patients who can virtually live in the sunlight, keep free of the disease most of the time. To obtain the same results as from sunlight, the patient should be irradiated daily, starting with small doses and gradually increasing the dose as tolerance develops. The treatment should be generalized, paying no attention to the actual lesions. Having this disease is probably one of the few reasons for a patient's having an ultraviolet generator in his home. Occasionally an erythema dose or a sunburn will result in the development of new lesions on the affected skin. This is especially true in the acute types. When this occurs, other methods of treatment should be used and if later ultraviolet light treatment is considered, avoidance of all acute reactions is requisite.

Lupus Vulgaris—The Finsen rays, produced by a powerful arc light, have been used successfully to treat this disease for many years at the Finsen Institute in Copenhagen. The ultraviolet generators in common use in this country are not as useful and results have not been satisfactory. A method which is reported to be successful is in utilizing a water-cooled quartz lamp. A blistering dose is administered and successive blistering doses are given before the reaction subsides from the preceding treatment. Fortunately lupus vulgaris is not as common in the United States, as in many European countries.

Scrofuloderma—While not in any way a specific, the administration of ultraviolet light appears to definitely and favorably affect the course of this disease. It should be given to the entire body and the treatment repeated at frequent intervals.

Erythema Induratum—(Bazin's disease)—As an adjuvant to other measures, heliotherapy appears to be a definite help in treating this disease.

Pyogenic Infections—In recurrent furunculosis, generalized ultraviolet exposures, appear to benefit the patient. Boils may sometimes be aborted by a vigorous exposure obtained by using the water-cooled lamp under pressure. Sycosis vulgaris, in my experience, has never shown any favorable results from heliotherapy.

Alopecia Areata—Local treatment of this disease consists of the use of stimulating remedies. Ultraviolet light offers a satisfactory method and may shorten the period of alopecia. Erythema exposures are given, so spaced that the irradiated skin does not completely recover from the previous reaction before the next treatment is given.

Premature Alopecia—When falling hair has as its origin a seborrhea, irradiation of the scalp by ultraviolet light may be helpful at times in conjunction with other remedies. In the idiopathic and senile types, very little benefit may be expected. When given, a mild erythema should be induced. During the exposure the hair should be constantly parted.

On the whole, heliotherapy has been very disappointing in treating alopecia. The modality has probably been exploited and abused more in this connection than in any other way.

Eczema—A type of eczema that seems to be benefited occasionally by ultraviolet light is that known as neurodermatitis. Benefit has been reported to have followed its use in infantile eczema, but this is doubtful. In vesicular and exuding eczema, the use of ultraviolet light in erythema doses is definitely contraindicated. Stimulating doses may be of benefit in chronic squamous eczema. The speaker has seen several cases of acute infectious eczematoid dermatitis apparently induced in patients who had eczema, from vigorous ultraviolet light treatments. It is probably needless to add that its use is absolutely contraindicated in infectious eczematoid dermatitis.

Pityriasis Rosea—One or two erythema exposures of ultraviolet light may result in the disappearance of this eruption. The disease of course is a self-limited one and the treatment is useful only in those patients desiring speedy recovery.

Fungus Eruptions—In dermatophytosis both in the primary eruption and in dermatophytid, little if any response may be expected from the use of ultraviolet light therapy. It is a useless procedure in tinea capitus, needless in tinea circinata and helps little in tinea cruris.

Naevus Flammeus—(Port - wine - mark)—Repeated blistering doses by a water-cooled lamp under pressure will finally result in improvement. The best results are obtained where the area is small enough to be covered by one exposure. In extensive cases, it is distinctly difficult to obtain an absolutely uniform blanching. In such cases, the final result is apt to be poor.

Telangiectasia—When produced by x-rays or radium, the treatment of telangiectasia offers a problem in therapeutics. While some benefit may be gained by ultraviolet light in blistering doses, the speaker has given up this method and relies upon other measures.

Adenoma Sebaceum—Ultraviolet light by the decompression method is a favorite and useful way of treating this disease.

Parapsoriasis—While prone to recurrence, ultraviolet irradiation offers perhaps the most satisfactory method for the treatment of this disease.[3] Many patients report that they are only subject to it during the winter months and that it disappears after one or two sunburns.

Angioma Serpiginosum—This rare dermatosis has been treated successfully by ultraviolet light in a number of instances. It probably offers the best remedy available at the present.

Contraindications to Heliotherapy

Besides vesicular eczema and infectious eczematoid dermatitis, ultraviolet light should never be used in those diseases in which an element of light sensitization is present. In xeroderma pigmentosum protection against sunlight is essential. In some instances lupus erythematosus follows an acute sunburn and the disease may be spread through misguided use of heliotherapy. Ultraviolet light therapy under decompression was formerly a standard method of treatment for this disease.

Conclusion

Ultraviolet light has a definite yet limited value in the treatment of skin diseases. For the most part this value is that of an adjuvant to other therapeutic measures. The use of heliotherapy is not indicated in every

dermatosis and is at times contraindicated. For these reasons an accurate diagnosis is requisite before a given condition is so treated. These also, are strong reasons against self-treatment with ultraviolet light by lay people unless under the supervision of a physician.

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RADIOTHERAPY IN GYNECOLOGY *

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OMAHA, NEBRASKA

This paper is limited to a discussion of the use of radiotherapy in the treatment of certain menstrual irregularities of benign origin; namely, the menorrhagia and amenorrhea of adolescence, and the menorrhagia occurring in later menstrual life.

The obsolete explanation for menorrhagia of adolescence, ascribing it to local disease of the endometrium, has been completely discarded; in its place the present day theory has been gradually advanced by the work of Schroeder,[1] Novak,[2] and others.

Schroeder's investigations have led him to the conclusion that the changes occurring in the endometrium during a normal menstrual cycle are dependent upon two ovarian hormones. The Graafian Follicle, as it develops, produces, through its hormone, a proliferation of the resting endometrium; under this stimulation the glands become hypertrophied and lengthened. When ovulation takes place, at about the fourteenth day, the remaining portion of the follicle develops into the corpus luteum. The hormone from the newly-formed corpus luteum transforms the endometrium into a secretory organ and prepares it for the reception of the fertilized ovum. If fertilization does not take place the endometrium disintegrates and menstruation occurs. At the same time the corpus luteum degenerates and a new Graafian Follicle begins to develop.

When, however, due to some disturbance in the pelvic physiology, ovulation does not take place, the follicle persists and no corpus luteum is formed. Consequently, the endometrium does not undergo the usual premenstrual changes; instead, due to the persisting follicular stimulus, the glands and stroma of the endometrium acquire an irregular overgrowth. This hyperplastic process continues until there occurs eventually areas of thrombotic necrosis and consequent hemorrhage. These observations have been substantiated to a great extent by Graves[3] in his examination of specimens removed at operation. This view is also supported by the observation that a period of amenorrhea frequently precedes the onset of the menorrhagia.

Obviously the treatment of such a condition should be directed towards the removal of the persisting follicle or follicles. Operative removal of the offending area by resection is mutilating in one so young and is usually unsatisfactory from a curative standpoint; this is due to the fact that the follicles are usually multiple and would require extensive resection of the ovary to insure relief.

Curettage will give relief in a certain few; in persistent cases it should be repeated from a diagnostic and therapeutic standpoint. A large number will correct themselves under organotherapy and general tonic measures. This leaves a small group in which the severity of the condition requires more radical measures.

Radiation of the spleen, as advocated by Paul Werner,[4] has in his hands proven effective in a number of severe cases. Its action was formerly thought to be due to the effect of the roentgen rays on the reticuloendothelial system; it is now generally be-

* Read at the Tenth Annual Meeting of the American Congress of Physical Therapy, Omaha, Nebraska, October 8, 1931.

lieved to be due to the increase in the blood coagulability caused by the liberation of larger amounts of clot-promoting ferments; these products are liberated through the destruction of blood cells and especially lymphocytes which is accomplished best in the spleen since it contains them in such large amounts. Changes in the blood, due to spleen irradiation, appear within a few hours and persist from two or three days, slowly disappearing. For this reason Werner did not employ this treatment with the expectation of permanent cure but rather to secure prompt control of severe hemorrhage. He reports, however, favorable results in 70 per cent of his cases; he believes this to be due to the removal of a temporary disturbance and that normal conditions had an opportunity in the meantime to re-establish themselves.

Menorrhagia of Puberty

The application of radium to the uterine cavity in small doses has been advocated for severe bleeding of puberty. Clark and Keene,[5] in 1922, reported its use in five cases in a series of 527 treated for this condition. More recently Stacy and Mussey[6] have reported its use in a series of fifteen cases over a period of eleven years at the Mayo clinic. It was used after all other methods of treatment failed and the condition demanded either hysterectomy or irradiation. Stacy and Mussey had good results in four of the fifteen, fair in six, with the remaining five requiring operation at a later date. Small dosage was used by all, varying from 150 to 250 Mgm. Hrs. as the initial treatment, the tendency being to under-radiate rather than run the risk of producing permanent cessation of the menses. Repetition of the treatment when done was postponed for at least six months. Schmitz[7] believes that pubescence is a definite contraindication to the use of radium, preferring rupture of the follicle bimanually under anaesthesia.

Chronic inflammatory disease of the pelvis or abdomen here, as elsewhere, is a contraindication to the use of the *gamma* ray; and the application should always be preceded by a diagnostic curettage, bearing in mind the possibility of early carcinoma, as subsequently occurred in one of Stacy and Mussey's series.

X-ray therapy has also been found useful in the treatment of amenorrhea. While occupied with the task of determining the proper dosage in the treatment of menstrual bleeding, Werner[4] discovered that very small doses of x-ray did not destroy the menstrual function but rather had a stimulating effect upon it. He began treating amenorrhoeic individuals and found that many returned to a normal menstrual cycle and that pregnancy, with delivery at term, occurred in some. Rubin[8] also reports pregnancy occurring after roentgen ray therapy. Rongy reports his results in 36 selected cases which had received other treatment without results. Of the 36, 22 returned to a regular menstrual cycle and pregnancy occurred in 8.

It is unnecessary of course to state that amenorrhea, due to general systemic causes is not amenable to this type of treatment. The ideal case would be one without systemic disease but with comparatively normal pelvic organs. Certainly a case with markedly hypoplastic uterus would give little promise of favorable results.

Rongy[9] believes that the stimulating effect upon the menses is due to the destruction, by the x-rays, of a persisting corpus luteum. This seems logical since we know that a persisting yellow body will cause a prolonged amenorrhea and sterility. "Free Martins" in cattle are examples of this.

The effect of irradiation on subsequent pregnancies has not been fully determined. Werner[4] discusses the possibility of developmental defects in the foetus. He cites animal experiments in which the first generation showed only retardation of growth and lack of resistance; in the second generation, however, the young were small and sterile with the occurrence of deformities. Further work is necessary along this line; unfortunately it will take several years to determine if similar conditions occur in humans.

Menorrhagia in Advanced Adults

Menorrhagia of the latter part of sexual life has until a few years ago been considered to be due entirely to tumors or myopathic changes occurring in the uterine body. The bleeding was ascribed to the mechanical interference with the uterine circulation in the case of fibroids and to the lack of normal musculature in the fibrosed uterus.

More recent investigations has pointed towards ovarian dysfunction as an etiological factor, just as it is in the hemorrhage of adolescence. Schmitz[7] says that 70 per cent of the endometrial hyperplasias due to a persistent follicle and associated with bleeding

occur between the ages of 41 and 50. This view is also supported by Graves[3] although he believes it to be some higher endocrine acting through the follicle; this opinion is based upon the absence of cellular activity in the follicular lining, in contrast to the activity found in adolescence. The same overgrowth of the endometrium, however, is present in a large number of cases, especially those with severe bleeding. These discoveries will tend to explain the hemorrhages that occur near the menopause in the absence of myoma or marked myometrial change. In all probability there are several causal factors, two of which may be the ovarian dysfunction and the changes in the uterine wall.

Having this knowledge at hand the treatment resolves itself into one of two lines of attack, either remove the bleeding organ or correct the ovarian dysfunction. The treatment is somewhat simplified by the age of the patient. She has by this time acquired her quota of children or if she has had none the sterility has persisted for so long a period that there is no hope of correcting it. For this reason the pathological uterus can be disregarded as a reproductive organ, which, so far as we now know, is its only function. Ovarian tissue, however, must receive more consideration; we know that abrupt cessation of ovarian secretion will precipitate, in the bulk of patients severe menopausal symptoms.

With this thought in mind we believe that surgery is the procedure of choice wherever practical. There occurs, however, a certain number of cases where operative removal is inadvisable or definitely contraindicated. Here radium is a valuable aid for the control of the hemorrhage. There should be no controversy between irradiation therapy and surgery, for each is definitely indicated in its own group of selected cases.

Contraindications and Indications for Radium

The contraindications to the use of radium curtail its use to a considerable extent; Schmitz[7] observes that they are so numerous that radium was employed only seven times in a series of 36 bleeding myomas. Keene and Kimbrough[10] in 254 cases used surgery in 73 per cent, radium in 21 percent, and x-ray in 4 per cent. The percentages are approximate. The hemostatic results were correspondingly good in all three groups; the mortality, however, was 2.15 per cent in the operative group as against zero in that treated by irradiation. This comparison is not entirely fair to surgery as the deaths occurred in difficult cases where radium was contraindicated. Clark and Block,[11] in a previous report from the same clinic, showed a mortality of nil in uncomplicated myomas treated by operation. On the other hand moderate or severe menopausal symptoms occurred in 30 per cent of the radium series as against 6 per cent in those treated by surgery where the ovaries were preserved. It is interesting to note that where surgical ablation of the ovaries occurred, the incidence of symptoms was greater than occurred in those treated by radium, indicating that cessation of ovarian activity after irradiation is not entirely abrupt.

Generally speaking we believe that radium is indicated in uncomplicated myomas in women near the menopause who are suffering from some abnormality which would render them an unsafe surgical risk. Keene considers the ideal patient for radiotherapy a woman in the fifth decade of life who has a tumor not larger than a three months pregnancy, the only symptom of which is profuse menstruation. We have preferred to use surgery even in those past forty whose general physical condition is good.

Unfortunately the frequent presence of complicating lesions narrows the field of radiotherapy in uterine hemorrhage, requiring operation in cases that would otherwise be suitable for that type of treatment. The intelligent use of the *gamma* ray in pelvic pathology requires not only the ability to apply it but also the faculty of recognizing certain conditions that render its employment unsafe; failure to follow these rules will end in disaster all too often.

Proper Selection of Patient

The patient's history should be carefully scrutinized and a careful examination performed. The size of the tumor should be noted. Tumors larger than a three to three and a half month's pregnancy are not generally considered suitable; larger than this they quite frequently show some benign degenerative change due to the deficient circulation which is peripheral in character. Further impairment by irradiation would only serve to increase the disturbance. Large tumors are frequently accompanied by adnexal disease

the palpation of which is difficult due to the uterine mass; the distortion of the uterine cavity, so common in marked enlargement, renders a thoroughly diagnostic curettage impossible; under such circumstances corporeal cancer cannot be definitely ruled out. Graves[12] calls attention to the frequency of the association of corporeal carcinoma with uterine fibroids. A rapid increase in the size of the tumor is indicative of benign degeneration or malignant change. Sarcomatous growth occurs in one to two per cent of uterine myomas according to Boyd.[13] Such tumors should be treated surgically.

Operative treatment is to be preferred in tumors showing marked pressure symptoms, for while the uterine mass decreases in size after irradiation, relief is slow and the patient is justifiably dissatisfied. The presence of pain, associated with fibroids, is indicative of chronic pelvic inflammatory disease, degeneration of the tumor or new growth, usually malignant, in the pelvis. The presence of menorrhagia in conjunction with ovarian malignancy should not be overlooked.

Quiescent infection in the pelvis is a definite contraindication to the use of radium, and its absence should be firmly established before proceeding. The intrauterine use of the *gamma* ray in the presence of inflammatory lesions, old or new, will result in the development of severe pelvic cellulitis and peritonitis. Prolonged illness or death is the inevitable result.

Pedunculated and submucous tumors do not respond well to radium; it is ineffective and may lead to necrosis and infection. Their presence can be determined by the curette.

Finally there are a number of women who are extremely nervous or who have a fear of radium which cannot be removed. Such patients are better treated surgically, since it is impossible to foretell the degree of menopausal symptoms following irradiation, and symptoms are usually more pronounced in such individuals.

The contraindications to radium are not so numerous in the treatment of the bleeding uterus that is tumor free. They are chiefly malignancy and latent infection. But especial care must be exercised, being mindful of the frequent association of menorrhagia with adnexal inflammation. Severe anaemia or cachexia out of proportion to the amount of blood loss should make one suspicious of malignancy. Uncertain diagnosis requires observation over a reasonable period, and surgery if the uncertainty still persists. Patients with profound anaemia should be transfused before being irradiated; anaemic individuals recover slowly and are apt to have severe reactions.

Application and Dosage

The application of radium to the uterine cavity should be considered an operative procedure. With the patient under anaesthesia a more thorough pelvic examination can be made. A diagnostic curettage should be performed in all cases for reasons mentioned above; following this, and without topical application of antiseptics, the capsule properly screened is inserted and the cervix and vagina firmly packed with narrow gauze. Only a moderate amount of urine should be allowed to collect in the bladder after operation. The rate of urinary secretion as determined by catheter will govern the frequency of catheterization.

Dosage varies in different clinics, the average being 1000 to 1200 Mgm.Hrs. Keene and Kimbrough[10] have gradually reduced their dosage, using 600 to 900 Mgm.Hrs.; they found decreased incidence of severe menopausal symptoms with the smaller dose. If the bleeding was not controlled, supplemental roentgen irradiation was used, since the possibility of fundal cancer had been eliminated by endometrial exploration at the time radium was inserted.

No detailed discussion of the roentgen ray will be undertaken except to say that treatment by this method should be reserved for those cases unsuitable for either radium or surgery. This is especially true since the x-ray can be used in the presence of latent pelvic infection. Dense adhesions due to an inflammatory process, sometimes renders operative removal impossible. Here roentgen irradiation can be employed to great advantage.

Summary

1. Ovarian dysfunction is considered an etiological factor in menorrhagia both in adolescence and at the menopause.

2. Intrauterine radiotherapy is indicated in the bleeding of adolescence only when the severity of the symptoms demand radical procedures.

3. Radiation of the spleen has proven effective in numerous cases of menorrhagia.
4. Roentgen irradiation has proven of value in the treatment of amenorrhea.
5. Radium, and less often x-ray, are indicated in selected cases of menopausal hemorrhage.

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Discussion

Dr. Joseph Mindess (Winnipeg, Canada): I do not know much about this subject except what I have read. In the main I have been interested in it merely from an academical standpoint.

In the case of fibromata of the uterus, sometimes they are uniformly placed and sometimes they are irregular. Is there any preference in methods of irradiation one over another?

Suppose we insert a tube containing radium. How can we be positive that all the different areas are equally irradiated? If for example the patient lies on one side, the tube is gravitated out of normal position, would not that side be inclined to be more radiated than the other? Is there any way whereby one can judge whether the patient could be exactly affected?

Dr. Maurice E. Grier (Omaha, Neb.): Insofar as the shape and size of the tumor, of course, that depends entirely on what portion of it continues to grow. This is a fibroma which anywhere else in the body is usually irregular.

Fibromas are supposed to start in the middle coat of the small arterioles. As they develop, of course, they develop on one side or the other of the arterioles. That is supposed to be the explanation for the reason that circulation in fibromas is peripheral in type. In other words, after the tumor reaches any degree of size at all the circulation comes from blood vessels that are on its external circumference. That is the reason for all the degenerative changes that occur in fibroids. It is entirely on a circulatory basis.

As far as the treatment is concerned, I should not think the shape of the tumor would make much difference, or the location. Tumors that are close to the external surface of the uterus give very few symptoms, and therefore generally require no treatment unless they increase to such a size as to cause pressure on surrounding organs. Then they should be treated by surgery. Tumors close to the endometrial cavity are generally the ones that give the most pronounced menorrhagic symptoms, so that in spite of the recent developments certainly the location of the tumors must have something to do with the disturbance of circulation.

In regard to the amount of irradiation or where it is placed in the uterus, it doesn't seem to make so very much difference unless the tumor is of extremely large size and treated by intrauterine radio therapy. I believe the effect upon a tumor is not only due to the radiation of the tumor itself but the effect upon the ovarian tissues. In other words, in order to control the hemorrhage to an absolute point it is generally necessary to secure sterilization.

Dr. Joseph Mindess: I am not positively clear yet about your explanation. You say it makes absolutely no difference how the uterus is irradiated because the irradiation will reach any point. It appears to me you think once there is absorption of energy it will be equally distributed throughout the tissue.

Otherwise, suppose the tumor is mostly confined to the right side of the pelvis and there is none on the left side. Suppose the patient has a habit of lying mostly on the left side. The tube in consequence will gravitate to the left side. It would appear to me that usually the left side would be irradiated, whereas the right side where the tumor is located will have no irradiation at all, or very little. I would like very much to be enlightened on this.

Dr. Maurice E. Grier (closing discussion): It is believed that the effective penetration of the *Gamma* ray insofar as the cancer cell is concerned is five centimeters. If one places a radium capsule within the uterus, and the carcinoma involves the opposite side from the place where the radium capsule is placed, the patient would have a sense of false security. You might think you were giving her effective radiation but the distance between the tumor itself and the ra-

dium would prevent the possibility of thorough irradiation of that area.

So far as the fibroids are concerned, the effect of radiation upon a fibroid is in two ways. First, it causes a fibrosis of the blood vessels of the uterus and in that way cuts down the blood supply to the uterus. In addition to that, it causes an increased fibrosis of the tumor itself, and as the tumor shrinks due to the increased fibrosis it interferes less with the circulation; but in addition to that there is also a concomitant irradiation of the ovaries, and it is this irradiation of the ovaries that I believe is responsible to a great extent for the cessation of bleeding in cases of bleeding from fibroid tumors.

In spite of the fact that the effect of penetration of the *Gamma* ray is five centimeters, certainly throughout all the intervening tissue there is additional radiation going on sufficient to destroy the Graafian follicle. If you destroy the primordial you prevent the development of the Graafian follicle and prevent stimulation to the uterus so that menstruation is not started. Once menstruation has started, the uterus seems to be inadequate insofar as its control over the shutting off of it is concerned, and that is demonstrated by the fact that the bleeding from menorrhagia contains clots while the bleeding in excess of normal bleeding, which is normal to the individual, does not clot because there is a sufficient amount of fibrin ferment secreted from the endometrial glands to keep it from clotting. After the bleeding has extended over the period of the available amount of fibrin ferment, then the blood clots. The adolescent menorrhagia as a rule does not clot because of the overstimulation of the endomentrium.

Dyes Used to Check Growth of Cancer-Like Chicken Tumor

Scientists who have been studying chicken tumors in the hope of throwing light on the problem of cancer in man have for the first time been able to destroy the activity of one of the chicken tumor-producing agents by means of dyes, it appears from a report of Dr. Margaret Reed Lewis and Warren Reed Lewis, of the Carnegie Laboratory of Embryology at the Johns Hopkins Medical School in Baltimore, to the *American Journal of Cancer.*

Chicken tumors are cancer-like growths caused by an agent called a filterable virus because it is so small that it will pass through pores of the finest filters. Viruses have been the subject of intense investigation in recent years but so far it has been almost impossible to destroy the activity of any virus by a dye as can be done for larger microscopic organisms. It is not known whether the virus is a living organism or a chemical substance.

Virus Extracted

The Lewises, a mother and son research team, extracted the virus from one of these chicken tumors so they could work with it in a test tube. They combined it with 80 different dyes. After being mixed with the dye, the virus was injected into the chicken to see if it could still produce a tumor. Two of the 80 dyes destroyed the tumor-producing activity of the virus. However, the investigators pointed out that the activity was destroyed in the test tube by an amount of dye which would be impractical to inject directly into the animal in the hope of destroying the tumor-virus in its body.

They consider 80 dyes a small number to have investigated. They feel from the results of their study that when a larger number of dyes are investigated, it may be possible to find more than two which can prevent the growth of tumors even when used in more dilute concentrations. Experiments on injecting the dye directly into the chickens suffering from this type of tumor are now being planned.

The world of science is already familiar with the studies of cell growth and cancer on which Dr. Margaret Reed Lewis has collaborated with her husband, Dr. Warren H. Lewis, and it is interesting to note that in this latest investigation she had the assistance of another member of her family, her son, Warren Reed Lewis, now a medical student. —*Science News Letter,* March 26, 1932.

Burton Baker Grover
1858-1932

Again the grim reaper has swung the Scythe, and snapped the thread of the life of a dear old friend. We shall find a vacant chair at the table. We shall sorrow and grieve for his absence. I only wish that I was competent to paint in words what Burton Baker Grover really meant to contemporary physical therapy. "I knew him well, Horatio, a fellow of infinite jest," and I shall miss his warm friendship, his good fellowship and his unending and perennial humor. With all these high personal attributes, a friend and citizen, he was also, a Scientist of high degree, and a practitioner of Art of whom we were all proud. It is upon such an occasion that I feel how cold speech or writing can be, compared to the emotions and the heart beats that throb within us.

Break, break, break,
On thy cold gray stones, Oh sea!
And I would that my tongue could utter,
The thoughts that arise in me.

O well for the fisherman's boy,
That he shouts with his sister at play,
O well for the sailor lad,
That he sings in his boat on the bay.

And the Stately ships go on,
To their haven under the hill,
But Oh, for the touch of the vanished hand,
And the sound of the voice that is still.

Break, break, break,
At the foot of the crags, Oh sea!
But the tender grace of a day that is dead,
Will never come back to me.

CURRAN POPE, M.D.

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E D I T O R I A L S

Extraordinary Program Completed for Eleventh Annual Session

EXCELLENT MEETING AND EXHIBIT FACILITIES PROVIDED AT HOTEL NEW YORKER

Every preparation has been made to give you an extraordinary program. The New York committee is waiting eagerly for the time to demonstrate its hospitality. New York has long awaited one of the annual sessions of the American Congress of Physical Therapy. Its opportunity has finally arrived and the Congress is looking forward anxiously for this gathering which promises to be the outstanding one in the history of the organization.

From the time the Congress was first organized the annual conventions have attracted large audiences. Each year there has been an increase in attendance, greater enthusiasm, a finer spirit of organization, and above all, a wonderful spirit of fellowship. There are no factions in the Congress, no political problems, nothing but a spirit of loyalty and interest. The Congress functions smoothly, and in spite of the depression, good progress is being made. New members are being added regularly, a fact which speaks well for any medical society in these trying times.

This year's session is truly one which should attract the interest of every physician who is interested in physical therapy. Some of the outstanding

contributions in medicine during the past few years have been made in physical therapeutics. Fever therapy by diathermy has attracted world-wide interest. Institutions are now busily engaged in the research of this problem. At the eleventh annual session, some of the most prominent investigators in this country will report on their work along these lines. This symposium is in itself of sufficient importance to the practitioner to invite his coming to New York.

But this is only one of the many features. There is the symposium on arthritis, one on urology and others on subjects of equal importance. Practically every specialty in medicine is represented by papers, conferences, clinics and addresses.

Those who are interested in eye, ear, nose and throat will have five days of a sectional meeting devoted to the specialty. The subject of electrosurgery in relation to the tonsils will be fully discussed. Not only will the merits of this method be pointed out, but also its limitations. Other papers dealing with the nasal accessory sinuses, the ears and the larynx will be presented by conscientious workers who have investigated their respective problems from laboratory and clinical standpoints. The application of physical methods in ophthalmology and otolaryngology has attained a definite status, and a rational understanding among specialists is strictly in order. This meeting should emphasize the good and the bad. The discussions should expose once for all, data which are genuinely scientific and reliable and those which are based more or less on over-enthusiasm and immature study and research.

The two new sections, one on stomatology, and one on colonic therapy, should add much to these newer fields which are being approached in an organized way for the first time. Certainly the spirit which has been manifested thus far is suggestive of a large attendance for these sections.

The joint session will open formally on Tuesday morning, September 6th, at 10 o'clock. After the call to order, brief welcome addresses will be made by representatives of several local and nearby county societies, by the president of the New York Physical Therapy Society, and by our honored guest, Dr. F. Howard Humphris, on behalf of the English societies and the Order of St. John. Then will follow the induction of the president-elect, Dr. Gustav Kolischer of Chicago, who will give an address on "Further Consideration of Diathermy in Malignancy." The morning's session will close after a presentation by Dr. Humphris on "The Treatment of Health by Light."

Each morning except Friday the sections will meet in joint session. Each afternoon the sections will meet independently for the presentation of papers within their own fields. The sections on Stomatology and Colonic Therapy will conduct their programs on Friday in morning and afternoon sessions. Saturday will be given over to clinics at more than fifteen of the leading hospitals in New York City. The schedule of clinics will be made known early during the week of the meeting.

Fellows and guests are urged to arrange their visit so that they will arrive in New York City on Monday, September 5th, for the purpose of attending the President's Dinner on the evening of that day. This is the only social function which the Congress will conduct at this convention. Guests and ladies are especially welcome. Aside from some brief talks by the president and the president-elect, a treat is in store for all. Dr. H. M. F. Behneman of San Francisco will give an illustrated lecture on "Historical Figures in Physical Therapy."

The technical exhibits should prove of unusual interest. The leading manufacturers will be represented and their newer equipment should be carefully inspected by all. There are improvements in apparatus which are constantly being made. These are usually demonstrated at the Congress sessions.

If you have not already made plans to attend this session, do so now. You will benefit from the diverse discussions on subjects of interest and importance to the entire profession. Invite your colleague and your assistant. Help the Congress and its officers in putting over a session which will long be remembered by those who attend it.

THERMODYNAMICS OF HEAT IN RELATION TO PHYSICAL THERAPY

The tendency to regard the action of physical phenomena with an attitude of smug superiority has frequently been the cause of that bigotry and intolerance which has resisted the acceptance of new or well established truths. The intimate biologic relationship of the individual to the energy recognized as heat is no longer a matter of speculation. The very warp and woof of material being rests on heat within physiological limits. Life, as we conceive it today, is bound to heat by chains whose inflexibility is of such importance that a variation of a few degrees in either direction from normal would result in its extinction. Life has been attuned to the harmony of cosmic oscillations wherein its beneficient *leit motif* is allocated in a few octaves of the electromagnetic spectrum. Intuitively biogenetic organisms tend to photo- and thermotropism. They are avid for light and heat, and prosper best under such influence. And no matter how hostile or partial one may be toward the mystic writings of the Ancients, their's was undoubtedly a summation of groping experiences that prompted the deification of light and its heat provoking effects.

The propinquity of heat to life has therefore been a subject of great study in the field of physical and biologic sciences. The appreciation of its possibilities as a therapeutic measure has grown with the mounting research in these respective fields. Looking down and far out over the past from the vantage point of today one can only marvel at the dogged courage, and the persistence that rewarded those explorers who first won a devious way through the wilderness of this discipline. As one often does not see the woods for wont of the trees, likewise one often is unable to conceive the orthodox and classical background of the therapeutics associated with heat transformation on account of the rich and colorful foliage hiding the action of the basic laws of Energetics.

A case in point is the existing dislocation in Physical Therapy between empirical findings and scientific interpretation of thermodynamic influences as provoked from the various sources of heat generators now used in medical practice. This has resulted in misunderstandings and lack of faith in its therapeutics, a situation which could readily have been obviated if teaching institutions would have stressed the biophysical background at least in the same degree as it has their clinical effects. No greater elevation could be added to physical therapy practice than the understanding of the physical nature of heat energy, the appreciation of the laws that govern its thermodynamic activity, and the inspirational influences of the lives of those pioneers who by groping persistence erected the vast structures upon which modern science rests so securely. A panorama of notable names flashes before one's mind, names of pioneers who have crystallized new approaches for our better understanding of the forces we deal with in physical therapy. The temptation to pay homage is resisted because of lack of space and the necessity to sharply limit our discussion to the immediate problem concerning the nature of heat.

Probably no other writer has so picturously stated the first law of thermodynamics (Convertibility of energy into one another without gain or loss), as Clerk Maxwell:[1] "The transactions of the material universe appear to be conducted, as it were, on a system of credit. Each transaction consists of the transfer of so much credit or energy from one body to another. The act of transfer or payment is called work." The introduction of electromagnetic energy into tissues by means of high frequency current, ultra-short waves, or by infrared generators is a biophysical transaction within the scope of thermodynamics. The result is a transference of credit, the utilization of which transforms electromagnetic or radiant energy into caloric energy within the tissues of the body. This sets off a series of reactions capable of provoking chemical and metabolic effects the potential of which is dependent upon the biotic nature of the structures involved and the external factors associated with the electrical transference of the energy.

Faraday[2] regarded electrical force and chemical affinity as one and the same by demonstrating that the quantity of electricity obtained was proportional to the amount of chemical change. Benjamin Moore[3] has pointed out that it is just in this transfer of energy that the various activities which we recognize as peculiarly vital show themselves. Ostwald[4] was so impressed by the universality of this law that he even incorporated it

into a philosophical system of conduct, called, "Imperative of Energetics." Its central theme may be translated thus: "Waste not free energy; treasure it and make the best use of it."

The introduction of such terms as "capacity" and "intensity" has not been limited to the study of physical phenomena alone. Physiologists, notably such men as Bayliss, Nernst, van't Hoff, Krogh, Warburg, and others, have long interpreted their findings on the basis of thermodynamic action. The effect of temperature on the rate of action has had wide attention by physiologists of note. van't Hoff[5] crystallized his experiences into the well known law that a rise of 10° C. usually doubles or trebles the rate of action. Nernst however discovered an apparent discrepancy in this postulate; namely, that the velocity of reaction is proportional to the square root of absolute temperature. The delimitation of the temperature coefficient in the velocity of physiologic process has been further modified by the studies of Krogh,[6] and Knowlton and Starling,[7] who have pointed out that velocity of reaction may be linear rather than a process of general diffusion. This basic concept however has not been disturbed by passing time, except that many of the so-called discrepancies are now further explained by the theory of quanta of Planck and Einstein. A classical and orthodox edifice has been built up around this postulate which has long explained the reaction of chemic and physiologic process, but seldom propounded in Physical Therapy teaching.

The conversion of energy into caloric units is today thus fortified by such a vast array of facts that detailed mention of them would be a waste of the reader's time, were it not for the unexplainable paradox of its universal acceptance in things related to chemical and physical phenomena but debatable wherever the same argument is invoked toward the proof of similar action in things medical. This situation no doubt has partially arisen from the fact that overcrowded medical curricula have often cut sharp corners in order to present the essential principles of the philosophy of medical practice. Only more recently have isolated instructions been offered in which significant attempts have been made to orient the medical student in the unity of physical and chemical action. In this connection it is remarkable to recall the broad (perhaps prophetic) vision of Claude Bernard,[8] in regard to the question of vitalism. His statement can profitably be exploited to strengthen our present contention that heat is not "merely heat" but rather a protean force much belittled and misunderstood:

> "There is in reality only one general physics, only one chemistry, and only one mechanics, in which all the phenomenal manifestations of nature are included, both those of living bodies as well as those of inanimate ones. In a word, all the phenomena which makes their appearance in a living being obey the same laws as those outside of it. So that one may say that all the manifestations of life are composed of phenomena borrowed from the outer cosmic world, so far as their nature is concerned, possessing, however, a special morphology, in the sense that they are manifested under characteristic forms and by the aid of special physiological instruments."

It is because our literature is becoming uncomfortably crowded with such fatuous expressions as, "There is no specificity in high frequency current, ultra-high frequency radiation," and so on, and that "the effect is only a matter of heat" that our voice is raised in defense of those artificial sources that are now used to provoke physiologic heating effects. In the face of what has already been said, plus the classical postulates of Joule, it would seem that there is sufficient drama in the production of heat and its consequent climax upon metabolism to stifle the critical yawns of most of those medical commentators who see in heat nothing more than heat. Such thoughtless expressions are unfortunately finding free reign in scientific medical journals and tend to influence an unthinking reading public against the scientific exploitation of heat therapy with instruments now current or about to be placed on market for medical use.

The situation is however never as depressing as the deep shadows that emphasize the vividness of the picture. Encouraging contributions of a high order have gradually replaced the enthusiastic but fumbling experiences of many well meaning pioneers. High frequency therapy has now received a new impetus by demonstrating its therapeutic value in the production and control of fever. An extraordinary series of contributions have recently been published in relation to the physiologic and therapeutic value of ultra-high frequency current. The "will to know" is now expressed by many scientific workers in related fields. An example readily at hand

is that of Bazett[9] in a contribution found elsewhere in this issue.

There is today undoubtedly a greater tolerance for physical therapy procedure emanating from the highest strata of organized medicine, and from the research members of recognized universities. It is high time that the teaching facilities in the respective medical institutions offering physical therapy become so organized and oriented in the many teaching problems associated with this discipline that its students receiving such instruction will come away with an orientation sufficient in its scope to leave these precincts with an appreciation of its classical background besides becoming an adept technician. It is the general conviction of those who can speak with highest authority on the subject that in the present renaissance of medicine a new chapter of medical practice is being written into future medicine by the impetus of the scientific work now developed by physical agents wherein heat therapy will receive its just recognition.

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THE NEW FELLOWSHIP CERTIFICATES

The ever-increasing demand for membership certificates representative of a national organization whose scope and prestige are now internationally recognized has resulted in the preparation of a specially printed certificate, of a highly artistic nature. These certificates will come to each member suitably and uniformly framed and will occupy approximately a wall space of 12 by 13 inches. It is desirable that these certificates be hung in convenient and prominent places to give identification of specialistic practice and the authority with which membership in our organization gives it.

These certificates will be distributed to the respective members at a cost sufficient to cover printing expenses. The price is $2.50, plus transportation charges. When ordering please indicate how you wish your name to appear. Print or type it so that it will be legible for the hand lettering by the artist.

It is needless to suggest that every member possess a Congress certificate. It will be an identification mark that one will often have cause to survey with deep satisfaction. Orders will be filled promptly, but at least two to three weeks are necessary to complete delivery.

FRAGRANCE OF THE WORLD

There is an old story to the effect that a bucolic citizen wandered, one evening, into the general store where he did his "trading" and, becoming mildly befuddled on the hard cider which was on tap, sat down behind the old base-burner and fell into a heavy doze.

The other chair-bottomers, their rather primitive imaginations stimulated by the same beverage, conceived the puerile and unoriginal idea that it would be highly entertaining to smear the sleeping one's moustache with well-ripened limburger cheese.

Waking just as this process was completed, the victim of this porcine jocosity sniffed the air a time or two, with an expression of surprise and disgust, and, without comment, went out into the night.

An hour later he returned and slumped into a chair with such an appearance of dejection and utter despair as prompted an expression

of solicitude from one of his tormentors, to which he replied in sepulchral tones, "My God, boys, the whole world stinks."

There is more to this recital than just a humorous anecdote. In these times of stress and unrest there are thousands of people who are so thoroughly upset and discomfited by the things that have befallen them that they are letting go their holds and succumbing to hopelessness, under the impression that "the whole world stinks."

For all such, the moral of this rather ribald story is obvious, if they can be brought to realize that the offensive odor emanates from a source immediately under their own nostrils, they will eagerly set about to remove it. Otherwise they will sink deeper and deeper into the slough of despond.

The world is just as lovely today as ever it was—just as full of light and color and music and fragrance and love and human sympathy and helpfulness. The only thing which has changed materially is our reaction to the circumstances of our environment. If evil-minded men or puckish fates have besmeared our spiritual upper-lips with metaphoric limburger, we will, unless we are as befuddled as the countryman in the story, recognize the source of the mephitic effluvium and be in haste to remove it.

When anything goes wrong with us, in any way, it is a ten-to-one bet that the source of the trouble is in ourselves, and until we find and diligently correct the maladjustments within, there will be small chance of ameliorating the distresses without. Self-examination is often a painful process, and self-correction a difficult, but both can be and have been accomplished, with immense benefit to the examiner and corrector.

"The world is so full of a number of things
That I think we should all be as happy as kings,"

and we *can* be, if we will remove the blue goggles of discouragement from the eyes of our minds and the pultaceous caseous material from under the nostrils of our imaginations and set out, glad-eyed and open-hearted, to sniff up the delightful and never-ceasing fragrance of the world and of life.—*Clin. Med. and Surg.*, (July) 1932.

Round Trip Fares to Convention of American Congress of Physical Therapy New York, N. Y., Sept. 6-9, 1932

			One-way	Round-trip 30-day
Birmingham, Ala.	to	New York	$35.56	
Los Angeles, Cal.	"	"		$119.77
San Francisco, Cal.	"	"		119.77
Denver, Colo.	"	"		76.97
Colorado Springs, Colo.	"	"		76.97
Atlanta, Ga.	"	"	31.11	
Chicago, Ill.	"	"	32.70	
Indianapolis, Ind.	"	"	29.20	
Des Moines, Ia.	"	"	45.59	
Sioux City, Ia.	"	"	51.04	
Dubuque, Ia.	"	"	39.23	
Dodge City, Kans.	"	"		76.97
Louisville, Ky.	"	"	31.32	
New Orleans, La.	"	"	48.34	
Shreveport, La.	"	"	52.94	
Detroit, Mich.	"	"	24.72	
Minneapolis, Minn.	"	"	47.36	
St. Louis, Mo.	"	"	38.06	
Kansas City, Mo.	"	"		76.97
Lincoln, Neb.	"	"	52.61	
Omaha, Neb.	"	"	50.63	
Charlotte, N. C.	"	"	21.75	
Asheville, N. C.	"	"	25.25	
Buffalo, N. Y.	"	"	15.72	
Cincinnati, O.	"	"	27.01	
Toledo, O.	"	"	24.39	
Oklahoma City, Okla.	"	"	57.59	
Portland, Ore.	"	"		119.77
Sioux Falls, S. D.	"	"	51.85	
Nashville, Tenn.	"	"	34.75	
Austin, Tex.	"	"	64.55	
Salt Lake City, Utah	"	"	87.77	
Seattle, Wash.	"	"		119.77
Miiwaukee, Wis.	"	"	35.76	
Air Plane, Chicago	"	"	29.50	

Air Plane, Round Trip Chicago $53.10, 90-day Stop Over, Trip Made in Seven Hours.

FRANCIS HOWARD HUMPHRIS

For the edification of the members of the American Congress of Physical Therapy, the readers of the ARCHIVES and the many guests at the forthcoming convention, we take pleasure in introducing our honored English guest, Francis Howard Humphris, by way of an abbreviated biographical sketch, all of which is much too short to round out a picture of a scholarly gentleman and a progressive physician who by unusual labors in the field of physical therapeutics has attained a ranking position among the pioneer leaders in this field of endeavor. The fact that we are still touching on the living activities of one who has perhaps reached the full bloom of his intellectual possibilities, must be taken into consideration when attempting to "round" out an expression of that which he has already accomplished. Judging from his past contributions we can only predict with mathematical certainty that as many brilliant facets will be added to the future totality of his intellectual activities as that which has already been attained. Nothing like a complete description is here attempted. We merely wish to point out, as it were, the indices of an active intellectual life which from past precedent promises future contributions equally as inspirational. Those who are about to attend the forthcoming convention will have the

pleasure of personal contact and will have the opportunity of carrying away a certain amount of practical information that Humphris has gathered from a rich experience on various fronts.

HUMPHRIS, Francis Howard, M.D., (Brux. Honours), F. R. C. P. (Edin.), D. M. R. & E. (Camb.), M. R. C. S. (Eng.), L. R. C. P. (Lond.), L. M. Rotunda, Dublin. Major R. A. M. C., T. F., retired; Officer St. John of Jerusalem; Cheval. Order of Leopold. Born at Croydon, May, 1866; son of late F. H. Humphris, J. P., Grove Mount, Ilkley, Yorks; mother, Ethel Marion, daughter of Col. Hesketh, I. S. C.; Education, Highgate Grammar School; privately, Edin. University; Royal College of Surgeons; University College of London. Tutor at University of Brussels, 1895-1898; 10 years in Honolulu; Supt. Insane Asylum; Senior Staff Physician, Queens Hospital, Honolulu; Examiner for License for Practice; President of Hawaiian Territorial Medical Society, etc.; came to London, 1908; for six months was Clinical Assistant X-ray and Electro-therapeutic department, West London Hospital; Served European War (Mons Star, 1914 War Medal, Victory Medal, despatches); Officer in Charge of X-ray department and department of Electro-Therapeutics Third London General Hospital. Sent to Egypt by War Office with rank of Major, R. A. M. C., to reorganize X-ray Departments in Military Hospitals in that country.

Past President of the American Electro-Therapeutic Association; Past President of Brussels Medical Graduates Association; Fellow of the Royal Society of Medicine; Past Vice-President Electro-Therapeutic Section; Past President of the Hunterian Society; President, Irish Medical Graduates' Association; Fellow, Medical Society, London; Consulting X-ray Physician to Guildhall School of Music; Hon. Consulting Physician to Theatre Royal Drury Lane; Hon. Consulting X-ray Physician and Electrotherapist to Christ's Hospital; late Hon. Consultant, Shell Shock Hospital (Lord Knutsford's Committee); Member of the Harveian Society of London; Member of the West London Medico-Chirurgical Society; Member of Roentgen Society; Member of the National Geographic Society, U. S. A.; Consulting Physician Specializing in X-rays and Electro-Therapeutics; Hon. Consulting Specialist Physician and Radiologist to the London Light and Electrical Clinic.

Publications: *Electro - Therapeutics for Practitioners*, 2nd edition, London: Oxford Medical Publications, 1921; *Artificial Sunlight and Its Therapeutic Uses*, 5th edition, London: Oxford Medical Publications, 1926; *Ultraviolet and Other Rays*, New York: Macmillan & Co., Ltd., 1930, London: Eyre & Spottiswoode, Ltd., 1930; *Physiotherapy, Its Principles and Practice*, London: Jonathan Cape, 1930. Address: 4, Great Stanhope Street, Park Lane, London. Tel. Gros. 1124 and 1646. Clubs: Savage, Windham, Pilgrims, Roehampton.

CURRENT NEWS AND SCIENCE

New York Polyclinic Offers Special Course in Physical Therapy

A communication from the medical executive officer of the New York Polyclinic Medical School and Hospital, Dr. F. H. Dillingham, calls attention to the preparation of a special course in Physical Therapy to be held at the foregoing institution following the meeting of the American Congress of Physical Therapy. These instructions will be given under the personal supervision of Dr. Richard Kovács and his assistants. The contents of the above communication reads as follows:

"The New York Polyclinic Medical School and Hospital will resume its standard course on Physical Therapy on September 12th, immediately following the Convention of the American Congress of Physical Therapy, so as to accommodate physicians who may want to enroll then.

"This course has been given regularly to several classes each year during the past six years, with participants from all states of the Union and from Canada, Mexico and even India."

The lectures and demonstrations will be so balanced as to include a broad survey of the various fundamental concepts related to the scientific interpretation of Physical Therapy. The clinical work will naturally be fitted into the didactic background. This special course offers an unusual opportunity for those desiring further instructions in this specialty.

The Colon Contention at the Forthcoming Convention

The adolescent spirit is often manifested at an age far removed from the middle of the second decade of life and may become extended or revivified even beyond the classical three score and ten. An example of what has been said comes to our attention from a letter by Frederick H. Morse, of Boston, which contained a silhouette picture of said individual's colon. Its vigorous and tonic outline certainly explains the virile intellect of the writer. Here undoubtedly is one case where a colon cannot be made into a semicolon. He writes:

"The enclosed explanation shows, with satisfaction, age extension, and a continuation of same, with no prospect of extinction. Therefore, this presentation and description of the absence of the usual colon angulation, is in opposition to the production of auto-intoxication. Hence it is my expectation to have the realization of continual procrastination of cremation. This rendition of my colon condition, shows a state of perfect elimination, which we hope will continue for a generation, and should be a guarantee of eternal salvation. All of which has been maintained without colonic irrigation, sine wave stimulation or any other physical demonstration.

"How different from the consternation, exasperation, mortification, vexation and lamentation caused by gas accumulation and abdominal distention, commonly caused "indigestion" which produces malignant formation."

"You know when I attend convention,
I hope for a contention,
About colon distention,
Not to mention my conferee's objection.
Therefore this will be an acceptation,
Of your invitation to the meeting you mention."

FRED. H. MORSE.

Announcing the Congress International De La Lithiase Biliare Vichy, France Sept. 19-22, 1932

Under the patronage of the leading clinicians and investigators of France, an important series of symposia dealing with ailments (particularly calculi) of the liver and biliary tract has been arranged. Representative authorities from the leading countries of Europe, North and South America and Asia will present these or take part in the formal discussions.

All phases of the subject chosen will receive attention. The sections upon roentgenology, experimental investigation and therapy offer unusual progress. The leading surgeons of Europe will present the latest in operation technique. There will be an unusual pathologic exhibit.

An attractive series of social and recreational features has been planned in a beautiful environment.

Participation in all the educational and social features of the Congress is secured by registration and the payment of a fee of 50 francs (French).

Reduced rates for travel and hotel residence have been secured.

The official program of the Congress and information respecting steamship rates, hotel accommodations, etc., may be secured by addressing,

FRANK SMITHIES, M.D.,
President of the Congress for the United States.
920 N. Michigan Avenue,
Chicago, Illinois.

Convention of British, Canadian and Ontario Dental Association

The attention of the dentists of the United States is again directed to the Joint Convention of the British, Canadian and Ontario Dental Associations to be held at the Royal York Hotel, Toronto, August 8-12, of this year. This will be the largest dental meeting ever held in Canada and our confreres in the United States are cordially invited as guests. The Golf Committee is arranging an International Dental Golf Tournament, so bring your clubs with you.

ARTHUR W. ELLIS,
ROBERT J. READE,
HONORE THIBAULT,
FRED J. CONBOY,
Publicity Committee.

X-ray Aids in Cases Which Never Yielded to Treatment

New Haven, Feb. 24. — Relief through the use of x-ray of a series of cases which never before have yielded to medical or surgical treatment, was tonight described by Dr. Harvey Cushing of Boston, eminent brain specialist, in an address to the Alpha Omega Alpha medical fraternity of the Yale medical school.

These cases, Dr. Cushing said, have baffled the medical fraternity, although their symptoms have been clearly distinct. Both in males and females the patients have grown stout, except in arms and legs, and have developed a heavy growth of hair on the face and their bones have become increasingly soft until they died.

Dr. Cushing believed that the disorder was caused by a tumor on the suprarenal glands, and on examination of the pituitary body, found a tumor on the anterior portion no longer than a millimetre in size, which took a basic dye. He finally selected a typical case which showed all the symptoms.

The patient was apparently dying, but Dr. Cushing exposed the pituitary fossa to four x-ray exposures and the man recovered enough in four days to return home. This is the first time, Dr. Cushing said, that science has been able apparently to accomplish successfully anything in cases of this type and with these clearly defined symptoms.

An Anti-Cancer Extract Found

A substance appearing to have remarkable power of controlling the growth of living beings and possibly of value in the treatment of cancer is being investigated in the laboratories of the Royal College of Surgeons of England and at King's College in London, Science Service informs us. The discovery is due to a young biochemist, J. H. Thompson, whose investigations seem to indicate that an extract of the parathyroid gland of cattle will restrict or prevent growth without endangering the health of the organism. The application of the method to the treatment of cancer is being tested in several London hospitals with what appear to be encouraging results.

The effect of the extract was observed on rats, rabbits, water cress and the axolotl, a form of salamander. In all cases the growth-retarding effect has been very marked. Treated rabbits have remained at about half the size of their untreated brothers and sisters and the germination of water cress seeds was entirely stopped by a 20 per cent solution of the extract.—(*The J. of the Missouri M. A.*, Feb., 1932.)

Sensitive Electric Eye Counts Light Quanta

An "electric eye" so sensitive that it can detect the ultraviolet rays from a lighted match at a distance of 30 feet has been developed by Gordon L. Locher of the Rice Institute.

This ultraviolet light detector, which will find many scientific uses, actually counts the individual electrons, liberated by effect of light on the surface of a photoelectric metal. It is similar to the cosmic ray counters that have been demonstrated to several scientific audi-

ences throughout the country. Like them it is hitched up to an amplifier and loud speaker so that the liberation of each electron can be heard as a click.

With this arrangement a candle at a distance of three or four feet produces a steady roar in the speaker.

Preliminary tests of the so-called "mitogenetic" rays have been made with this apparatus. These very faint ultraviolet rays, believed to be given out by rapidly dividing cells, for instance in growing root tips and in yeast cultures, were not detected by the new quantum counter though the apparatus was arranged for highest sensitivity.

The apparatus may be called a "quantum counter" since the setting free of each electron requires exactly one quantum or energy-atom of the incoming light. In the usual photoelectric cell it requires very many quanta of light to produce a measurable effect on the instrument.—*Science News Letter,* February 20, 1932.

X-Rays Detect Lead Poisoning in Children

A new method of diagnosing lead poisoning by means of x-rays has been reported to the American Medical Association by Dr. Edward C. Vogt of the Infant's Hospital and the Children's Hospital at Boston. When lead is absorbed into the body it is stored in the bones and can be detected in the x-ray pictures as a dense band at the growing margin, Dr. Vogt stated. Its elimination following treatment can also be observed by means of x-ray pictures.

Dr. Vogt pointed out that lead poisoning is a frequent and serious condition in children and one not always easy to diagnose. The dark line, called the lead line, at the margins of the gums is significant of the disease in adults but is seldom seen in small children, and the other diagnostic tests require considerable technical skill.

"The most frequent source of lead affecting the health of infants and children is from paint off the furniture, woodwork and toys," said Dr. Vogt. "As everyone knows, infants have a common tendency during the teething period to chew at anything they can get into their mouths."

When sufficient lead paint has been eaten in this way, symptoms of lead poisoning develop. This happens most often between the ages of one and two years.

The x-ray test for lead-poisoning cannot be used alone, Dr. Vogt pointed out, as some other conditions give the same or nearly the same picture, but together with other evidence, such as a history of chewing painted toys, it is very useful.—*Science News Letter,* February 20, 1932.

Congress of the Sciences

The Società italiana per il progresso delle scienze held its annual congress recently in Milan, and comprised a medical section and a biologic section.

In the section on biologic sciences, Prof. Nicola Pende, clinician at the University of Genoa, presented a paper on the neurochemistry of the aged and on the physiopathology of senility. According to biologists who have studied the multiplication of isolated and collective tissues, senility and death are due not to an inevitable intrinsic diminution of the vital energy of every tissue, after a number of years, but to a progressive alteration, through the effects of life itself, of the humors in which the living tissues are immersed. If the humors are renewed, the cells take on again their productive, reproductive and vegetative energy. The connective tissue, heretofore regarded solely as a supporting structure of the more differentiated organs of the body, is that which forms and maintains the chemical agent that bathes all the cells, fixes and destroys the foreign elements that penetrate the organism, and repairs the losses and partial destructions of the tissues. It is therefore necessary, before the connective tissue reaches a state of fibrous degeneration, to stimulate its vitality, to restore it and to liberate it from its acidosis. These are the modern means on which the hopes of retarding the involution process are based. Researches that Professor Pende has carried out in this direction show that such an ideal is not unattainable if one can successfully combat by means of suitable lavages the senile acidosis and can stimulate the vitality of the connective tissue. Professors Migliavacca and Marinuzzi participated in the general discussion.—*Jour. A. M. A.,* (January 16), 1932.

THE STUDENT'S LIBRARY

PHYSICAL THERAPY. By *John S. Coulter*, M.D., Assistant Professor of Physical Therapy, Northwestern University Medical School, Chicago. Cloth. Pp. 142 with 15 illustrations. Price $1.50. New York: Paul B. Hoeber, Inc., 1932.

To the *Clio Medica* series has been added another handbook, the nature of which will not only bring to its fold additional luster, but because of its scholarly rendition will, we predict, long be used as an important reference text to the growing study of physical therapy. Coulter has by painstaking labor added to the edifice of this discipline by contributing an erudite work on the history, evolution and background of physical therapy. Not only should this work be considered as an essential contribution because it has brought to our attention under a single volume the many hidden tributaries of the oldest art in medical practice, but it has bound together for the students' edification the many related but hitherto unclassified practices under a single head. The reading of this volume is as interesting as it is inspiring because it takes one back to the very beginning of the healing art. The author points out its persistent struggles for recognition, the intermittent periods when it was accorded a moiety of orthodox acceptance, and its past failures to maintain its position in the progress of the healing art parallel with pharmaceutical and surgical practice. Its revival throughout the ages may be taken as an index of inherent virtues or perhaps of its substantial therapeutic value in spite of the muddling methods of its disciples.

The book is replete with historical detail and references of a scholarly nature, and indicates the extensive labors entailed in bringing these facts together within the scope of a single volume. The material has been classified into five chapters, a bibliography of generous proportions, and an index of personal names and subjects. It discusses concisely the following subjects: I. Physical Therapy from Ancient Times to the Renaissance. II. Massage and Exercise. III. Water. IV. Electricity. V. Radiant Energy. By this contribution the author has anticipated a long felt need and has bridged an existing gap in this discipline. The historical facts have been conservatively but intelligently evaluated and presented in a literary form that makes it equally impressive as a scholarly document and as an authoritative commentary on the subject.

HEART DISEASE. By *Paul Dudley White*, M.D., Instructor in Medicine, Harvard Medical School; Physician, Massachusetts General Hospital, Boston. Cloth. Pp. 887 with 119 illustrations, tables and charts. Price $12.00. New York: The Macmillan Company, 1931.

Here is a contribution which approaches so closely to the expression "classical," that a review of its contents can only elicit monotonous praise. It is the type of contribution that fulfills all the hopes expected of a rounded text on the subject. It is teeming in information and well selected detail. It stresses the important considerations associated with all the clinical and academical factors in diseases of the heart. Written for the clinician, it represents a successful effort in placing before the medical profession a clear, concise and comprehensive work on the diagnosis, and treatment of heart disease in the light of present knowledge on the subject. As may be anticipated the author has introduced an exhaustive amount of information backed by a comprehensive bibliography, so focused in its perspective as to make the clinical side of the subject loom in greater outline than its theories. Since its purpose is largely directed toward practical interpretations of the disease aberations found in heart activity, it has relegated the details associated with anatomy, physiology, pathology, pharmacology, or instrumental technic, fundamental though such knowledge may be, to the background, rather than the foreground of its consideration. The effort and the purpose of the author has largely been to distinguish between facts and theories and of the application of the facts for the control and relief of the cardiovascular situation encountered. The work contains 34 chapters, an exhaustive bibliography and an appendix dealing with unsolved cardiovascular problems, all of which has been in turn divided into four sections: I. Cardiovascular Examination. Symptoms and Signs. II. The Incidence, Causes and Types of Heart Disease. III. Structural Cardiovascular Abnormalities. IV. Disorders of Cardiovascular Function.

Confronted with a work whose perfection is so obvious, it would appear to be the better part of logic to omit the repetitious praise and to call attention to the wide need of such a work by every practitioner, whether specialist or general practitioner. The book possesses the happy advantages of combining information encyclopedic in scope as well as guidance so practical and detailed in nature that no practitioner can well afford to be without it. The classification of the subject matter has been logically arranged as to offer a leisurely post-graduate course in cardiac disease. The book undoubtedly will come to be considered as the high water mark of contemporary contributions on the subject.

CUTANEOUS X-RAY AND RADIUM THERAPY. By *Henry H. Hazen*, A.M., M.D., Professor of Dermatology, Medical Department of Georgetown University. Cloth. Price, $3.00. Pp. 166, with 28 illustrations. St. Louis: C. V. Mosby Company, 1931.

This small volume is essentially a practical text on x-ray and radium therapy in accessible lesions of the skin. A third of the contents is devoted to the

theories, technics and laboratory information on the subject; the major portion deals with the practical application of radiation to certain forms of skin disease. It covers a field in which orthodox medication has been insufficient in results and where radiation is of greatest service.

Although the author qualifies the brevity of his contribution by stating that it was purposely intended "To write a short essentially practical book that will aid in the selection of cases for irradiation and offer safe advice as to technic with warnings against many pitfalls," its abbreviated form has reacted in an unfavorable fashion by clouding the exposition in many places. It has most of the faults of brevity without the latitude of detail found in the more ambitious works in this field. An example of this is the dogmatic appraisal of Grentz rays, without a single reference to establish the premise. Similar impressions are gained from other sections of the book. A critical evaluation of the work, however, leaves the conviction that aside from isolated differences as regard its brevity and its dogmatic exposition of the limited value of radium, the book is a practical contribution to the management of many difficult skin lesions. In that respect it fulfills the author's hope of its usefulness to the medical profession.

KURZWELLENTHERAPIE; Die Medizinische Anwendung Kurzer Elektrischer Wellen (Short-Wave Therapy: Medical Employment of Electrical Short-Waves). By *Dr. Erwin Schliephake,* Privatdozent für innere Medizin an der Universitat Jena. *Foreword* by *Prof. W. H. Veil,* Director der Medizinischen Univ.-Klinik Jena; with an *Appendix of its Physical Formulas* by *Dr. L. Rohde,* Jena, Assistant at the Technical Physical Institute. Paper. Price, Rmk. 10 ($2.50). Pp. 174 with 120 illustrations. Jena: Gustav Fischer, 1932.

Short-wave radiations, commonly called ultra-high frequency current have long been recognized for their intriguing possibilities in relation to applied therapeutics. Considerable research has been independently carried out in recent years, shared in a major extent by the author of this text. The work has attempted to summarize the most authoritative contributions by the various workers in this branch of radiation and incorporated the extensive personal experiences of the author in the related fields of biophysical and clinical research. The foreword by Professor H. W. Veil indicates the promising possibilities of the foregoing studies. The contents are divided into the following eight sections: I. Methods of Producing Short Electrical Waves for Purpose of Medical Application; II. Various Methods of Employing Electrical Oscillations; III. Short Wave Radiation; IV. Experimental Data; V. Its Influence on Disease Produced in Animals; VI. Treatment of Various Human Affections; VII. Conclusions Drawn from Above Studies; VIII. Appendix: Formulas pertaining to the physics of radiation.

From the foregoing outline of contents it becomes apparent that a well rounded discussion pertaining to short-wave radiation has here been attempted. The incorporated data is a striking example of the rich material that has been contributed to this branch of study. The author has gathered together the important and interesting facts and has coordinated them as a part of his thesis. He has explained the physical principles upon which ultra-high frequency currents manifest their best action. He has fortified his premise as to its therapeutic value by calling attention to the unusual array of experiments, culled from the scientific studies of contemporary workers in this field. It should perhaps be noted that in spite of the convincing facts included, the author has failed to make use of the many recent reports published by American and English workers—a fact which while not detracting from its main exposition, nevertheless reflects against the broad scholarship of his contribution. In line with the foregoing criticism it is also surprising to note that the author has failed to incorporate an index to his discussion, a section always essential to the rounding out of scientific treatises.

The work however contains such a wealth of impressive data that it undoubtedly strikes the highest note as a timely contribution. It has correlated a convincing array of laboratory experimentation in which has been coupled the effects of short-wave radiation in connection with biophysical, serological and physiological investigations. It has demonstrated the difference in the penetrating qualities of diathermy against that of short-wave radiation. It has also demonstrated the heat gradients of different wave-lengths, from which has crystallized at least one fact, namely, that condensor field radiations provoke deeper heating effects as distinguished from diathermy or that of infrared generators. It has furthermore directed attention to the practical, rather than to the academical, features of these radiations by a convincing array of clinical reports. The book, in spite of a few shortcomings, is undoubtedly the best contribution thus far published. It embodies a scientific attitude unusually well rounded out by tables, graphs, superior illustrations, and case histories. We consider this contribution so timely and important that we urge its translation into the English language for the convenience of those not able to read it in the original.

SURGICAL ERRORS AND SAFEGUARDS. By *Max Thorek,* M.D., Surgeon-in-Chief, The American Hospital, Chicago; Attending Surgeon, Cook County Hospital; Corresponding Member, Société Des Chirurgiens De Paris, France; Associate, Royal Academy of Medicine, Torino, Italy, etc. With a Foreword by *Arthur Dean Bevan,* M.D., Professor and Head of the Department of Surgery, Rush Medical College of the University of Chicago. Cloth. Pp. 796 with 668 illustrations. Price $10.00. Philadelphia: J. B. Lippincott Company, 1932.

Seldom has so interesting a theme as the foregoing come to the attention of the reader with greater reason for its birth, or one that has prefaced the labor entailed with greater modesty. The book is the crystallization of a quarter century of assiduous labor in the surgical field and is endowed with a rich background of personal experiences, exemplified by cryptic statements the literary turn

of which suggests the pithy aphorism. "No person," states the author, "is so perfect in knowledge and experience that error in opinion or action is impossible . . . . No surgeon, no matter how skillful or proficient he may be, should ever consider himself beyond the possibility of error or accident . . . . While it is human to err, it is inhuman not to try, if possible, to protect those who entrust their lives into our hands from avoidable failures and dangers."

As an example of modesty that borders on the *mea culpa* confessional tones, Thorek offers to the profession the results of many years of labor "without presumption or vanity, as a mentor to those who are entering on the perilous paths of surgical practice . . . because of his own mistakes and the dangers which he himself has met, the author is filled with the keen desire to impress their possibility on others, so that they may benefit from his failures and disappointments." The foreword by Professor Bevan is in direct sympathy with the splendid work of the author. Bevan feels that in spite of the great progress made in this branch of medical practice, "the faults although small, indeed, to the great advances made in this field, should however be eliminated in the interest of the profession, in the interest of the science of medicine, and in the interest of the public."

The treatise is divided into fifteen chapters, the contents of which incorporate detailed critical discussions in the many phases of surgery subject to error, which must be safeguarded for the welfare of the patient and the advancement of this science. The pages abound in bold face underscoring of important points, graphic descriptions and rich illustions which hold one's attention to important leads in the discussion. Soon one becomes impressed that undoubtedly here has been contributed a timely corollary to the many existing texts on surgery. The book bridges over the many uncertainties that often confront the operator prior to, during and after surgical intervention. It decries the surgical furore and the spectacular operations that endanger the lives to a greater extent than is assured by the surgical risk. It argues for conservatism consistent with efficiency, simplicity of technic, operative skill, expedition without the sacrifice of speed, and thoroughness of work even at the sacrifice of speed. In short, the reader has reflected back to him the summation of the rich experiences of one who has been well endowed to speak with authority on the subject. The work as a whole is so timely and well balanced, that it can be highly recommended to the medical profession.

DIE QUARTZLAMPE UND IHRE MEDIZINISCHE ANWENDUNG. Mit Einer Anhang über Wärmelapen. Einhchobuch. By *Dr. Erich Wellisch,* Assistant Des Institutes Für Physikalische Heilmethoden Im Krankenhaus Der Stadt Wien. With a Foreword by Primararzt *Dr. Josef Kowarschik*. Paper. Pp. 168 with 80 illustrations. Price, R.M. 8.60. Vienna: Julius Springer, 1932.

The need for a practical treatise on ultraviolet therapy, one that embodies a digest of the most authoritative information on the subject, has been realized by the publication of the foregoing text. Coming as it has from under the wing of Kowarschik's influence, one should anticipate nothing less than a concise and practical interpretation of the subject. The book is a notable example of clear discussions pertaining to the essential facts connected with the theories, practice and historical background of ultraviolet therapy. It contains a foreword by Kowarschik which calls attention to the long need of a practical treatise on ultraviolet, one that would get down to the bedrock of the subject, such as this work has attempted. The subject matter has been well organized and includes a fairly broad survey of both the theoretical and practical side of this discipline. It is separated into five sections, the order of which is as follows: I. Physics of Light; II. The Structure of Various Quartz Lamps; III. The Technic of Quartz Lamp Radiation; IV. Physiologic Effect of Ultraviolet Light; V. Clinical Indications for Quartz Light Therapy. The subject is introduced with a discussion of the historical evolution of light therapy, which also attempts to evaluate the relative virtues of light as a therapeutic measure. There has also been appended a chapter which discusses the relative value of heat from infrared and visible sources.

The author has undoubtedly reviewed the accumulated facts in ultraviolet radiation with a view of emphasizing the practical rather than the theoretical side of the subject. Every fact is translated toward its practical application. One observes as one advances deeper into the multiple phases of its exposition, that the author has gradually lengthened his discussions on clinical indications as to equal the four preceding sections dealing with the theories of the subject The references are authoritative but somewhat restricted to German speaking contributions. In this the book has weakened its universal appeal because it is now generally appreciated that science recognizes no national nor linguistic boundaries. For example, of the many books published on the subject, the author makes mention only of a single one published in English, one that has already passed through an edition other than that referred to here. He mentions none of those published in America, nor has he called attention to work of American men, such as Steenboch, Bachem, Macht and Mayer. One often finds in these pages mention made of the names and of the work of certain investigators without giving credit to their contributions by the customary footnote or bibliography. An example of typographical carelessness is found on page 81 which refers to the work of Hollender and Cottle, mispelled, "Holländer and Cuttles." Such carelessness in editorial supervision soon leaves the impression that there are many existing flaws in the structure of this volume and questions the complete orientation of the author. There is in spite of what has been said much in these pages that recommends the work as outstanding. It only needs very little revision to make it an ideal book on the subject, strengthening its exposition and its literary make-up that it will become the accepted text in other lands than that of the German speaking people. The book has had splendid mechanical support from the publishers, which is exemplified by the clear and well balanced type and the beautiful illustrations.

INTERNATIONAL ABSTRACTS

Diathermy in the Treatment of Gonococcus Cervicitis and Urethritis. T. J. Williams.

Am. Jr. Obst. and Gynec., **23**:575, (April), 1932.

Williams' study is based upon 38 patients wherein the focus for the organisms in 20 instances was cervical and in 31 urethral. A cervical thermophore was the active electrode for both the urethra and the cervix, and the dispersing electrode was placed alternately on the abdomen and the sacrum. The number of applications averaged 6 for both the urethra and the cervix, and the time of each treatment was 10 to 60 minutes. All of the patients were hospitalized for treatment. The following is the author's summary:

Satisfactory clinical and laboratory results were obtained in 20 per cent of the series of patients with gonococcus cervicitis and in 26 per cent of those with gonorrheal urethritis by diathermy treatments alone. No serious complications followed the applications. The average hospital stay of the group was three weeks longer than that of a similar group of patients treated by other procedures.

Diathermy to the cervix and urethra may be looked upon as an adjuvant in the treatment of gonococcus infections of these structures, but not as a positive cure even when temperatures of 115° to 116° F. may be maintained. Williams believes that equally good results may be obtained by the simpler methods of treatment more commonly employed, and are inclined to the opinion that when diathermy gives good results they are due to the increased vascularity induced rather than to actual thermal destruction of the gonococci.

The Diuretic Effect of Natural and Artificial Mineral Waters. Lauer.

Münch. Med. Wochenschr., (November 13) 1931.

The author states that he has made some observations on human beings as to the comparative diuretic effect of natural and artificial mineral water. Specifically he employs water from the Helenen Spring at Wildungen and also an artificial water showing chemically practically the same constituents.

He found that the natural water had an easily demonstrable diuretic effect in a wide variety of kidney diseases and that no such effect was approached by the artificial water.

This is a very interesting observation. The belief which the general public has in the curative effect of certain spas has long been something of a puzzle to the profession and many of us have been inclined to think that there was a good deal of superstition about it. At the same time we have seen an occasional patient who seemed to be greatly improved by the drinking of some sort of bottled mineral water. His psychic condition at least has been helped and we may be inclined to say that this is merely the result of suggestion.

Evidences are increasing, however, which seem to show that there is something in natural mineral water which is not readily discoverable upon chemical analysis and which nevertheless does add very greatly to its therapeutic effect. Artificial waters, of course, do not contain it.—*Uro. & Cut. Rev.,* Feb., 1932.

Effects of Concentrated Ultraviolet Light on the Skin. S. Lomholt.

Brit. J. of Dermatology and Syphilis, **43**:385 (Aug. Sept.) 1931.

Lanholt in his studies on the effect of ultraviolet rays on the skin, has found that those rays with wave lengths from 3200 to 3600 A. U. have the most active biological effect. On the basis of these findings a new carbon arc light for the Finsen treatment of lupus and other skin disease has been constructed which concentrates these rays, and is also screened with colorfilters so as to eliminate the infrared and some of the rays of the spectrum. The characteristic effect of the ultraviolet irradiation of this type on the skin is its elective destruction of the cellular elements, especially pathological cells, whereas it has little effect on the supporting tissue and its fibrils. "This makes it possible for the skin to regenerate in its original form." This new lamp, like the original Finsen lamp, has been used chiefly in the treatment of lupus and other forms of skin tuberculosis. It has also been used with good results in cases of neurodermatitis with severely itching plaques; in naevus flammeus; in xanthoma of the eyelids; and in atrophy of the skin due to exposure to the x-rays. In the latter condition short exposures to this concentrated arc light produce a weak reaction in the atrophic skin followed by comparatively active regeneration with new formation of blood-vessels.

Radium Therapy. Kumer.

Wien. Klin. Wochenshr., (October 2) 1931.

This article discusses in detail the properties and therapeutic effects of radium. It distinguishes between hard and soft rays and shows that they have a deeper penetrating power than x-rays, being able to pass through 10 cm. of lead. This property of radium therefore makes it more efficient than x-rays wherever both are used. The author also distinguishes gamma rays from ultragamma rays, the latter bring the cosmic rays, which exists everywhere in very small quantities. We are subject to a certain extent not only to these rays but also to minute radium rays which are widely distributed in many watering places. The exact effect of both of these rays (cosmic and minute radium) is not at the time definitely known. No doubt they play some rôle of importance, the nature of which may be transformation of heat and maintainance of life

The effects of measured doses of radium on the skin is as follows:

Cases already treated and especially those treated with Röntgen rays are often refractory to radium. On the other hand a too weak radiation with radium is not harmful as was once supposed. There is no proof that it stimulates a growth of malignant tissue.

Glandular metatases are in general refractory to the emanations of radium.

In treating carcinomas of the skin, lips and mouth, radium is the treatment of choice. The basal cell carcinoma reacts better than the horny epithelioma. Where the tumor has risen on the basis of some old disease of the skin, such as lupus, the outlook is always doubtful. Cancer of the ears and of the backs of the hands is also difficult to treat with radium. On the other hand the pre-cancerous dermatoses, such as Paget's disease, react in general very well.

Angiomas of the skin respond well to treatment with radium, and keloids while they are resistant to any treatment, nevertheless respond better to radium than to anything else. Warts, psoriasis of the nails and leucoplakias are favorably influenced by radium. Chronic paronychias will yield to radium when not influenced by any other agent. The same is true of plastic induration of the corpora cavernosa. Among 80 cases treated at the Vienna Radium Institute for induration of the penis more than one-third were cured and another third were improved.

Activated Ergosterol In Radiation Sickness. Lester A. Smith.

Roentgenol., 22:317, (Oct.) 1929.

The clinical picture of radiation sickness may be (1) immediate, consisting of malaise, loss of appetite, headache, vomiting, fever, diarrhea or acute prostration, or (2) late, with nausea, abdominal pain and distention, fever, diarrhea, general weakness and fatigability or even cachexia. The theories are: (1) toxemia from broken-down proteins or lecithin lipoids, (2) a decrease in the cholesterol content of the blood, (3) a shift of the body chlorides, (4) an alkalosis and (5) an increased vagus tonus. The oral administration of activated ergosterol produced marked relief from all symptoms, except possibly the diarrhea. Used as a prophylactic, ergosterol prevents all symptoms to a marked degree, the same results occurring apparently in both radium and roentgen treatment. Many of the patients experience an unusual sense of well-being and increased appetite. The action is probably effected in some way through the calcium-phosphorus metabolism. There is some evidence that the final effect may be brought about through the prevention or reduction of hyperirritability of the vagus. A bibliography is appended.

Roentgen Therapy of Psoriasis. Dr. K. Hőde.

Duetsche Medizinische Wochenschrift, No. 14, 1931.

X-ray therapy is rejected by a number of authors while others recommend it. The doses prescribed, however, vary considerably; some administer 2 to 3 SED within one year, others recommend quite small individual doses up to the total amount of one SED per annum. The author reports that recently serious injuries to the skin were noted repeatedly in consequence of x-ray treatment with psoriasis patients, whose skin probably was hypersensitive to the rays. As Roentgen therapy by no means leads to permanent cures, it is not superior to treatment by ointments, merely more pleasant and cleaner, and is therefore particularly indicated for cases of psoriasis efflorescences on parts of the body not covered by clothing. The law courts will, in the future, no doubt judge that x-ray injuries, incurred during treatment of psoriasis, are the fault of the doctor, all the more so if too high doses of x-ray have been applied. But even without any excessive doses, even after years, subsequent injuries may arise. — At the Würzburg dermatological clinic the following rules are established for x-ray treatment:

It is forbidden to administer x-ray treatment without extensive previous attempts with other remedies (salves, ultraviolet, etc.). Acute eruptions are never radiated. The use of x-ray is a mistake if the patient states that he has already been irradiated on the spot in question, or if even the slightest signs of previous irradiation can be noted, such as extension of vessels or pigmentation. The general counterindications should also be observed, such as simultaneous arsenic cures, diabetes, etc. Furthermore, the irradiation of all parts of the body covered by clothing should be avoided, particularly on the elbow, a favorite spot and seat of sporiasis, where injuries to the skin are apt to occur. — Permitted is the irradiation of the face, lower arms, the back of the hands and nails. Irradiation of the hairy scalp had better be avoided, because of the danger of the hair coming out. — The individual dose amounts to from 5 per cent to 20 per cent SED, usually filtered through 0.5 mm. of aluminum. The same field may, within four weeks, only be irradiated twice, at the utmost three times, in this manner. The repetition of an individual application is only allowed after several months. Altogether within one year at the most one SED may be applied to each spot. The doctor should draw the attention of the patient to the danger of too frequent application of x-rays. It is best to have this warning confirmed by writing and to demand a written statement that the patient has not previously been irradiated. — (*Ars Medici, Vol. IX, No. 8, Aug., 1931.*)

Quartz Light and Milk Secretion of Women. Drs. E. Lesne and G. Dreyfus - See.

Le Nourrisson, No. 2, 1931.

The authors have tested the method, indicated by Stolte and Wiener (»Ars Medici«, 1929, p. 264), of quartz light irradiation on the female mamilla for the promotion of milk secretion. The mammae were irradiated daily, the nipples being anointed with vaselin, with increasing doses of from 5 to 25 minutes, according to toleration. Distance of lamp from 80 to 70 cm. The rest of the body was uncovered. Among 15 women irradiated in this manner the treatment was successful in ten cases. There never occurred any sudden increase of milk secre-

tion, but a slow progress was always attained from a quantitative as well as a qualitative point of view. The milk in its chemical composition appeared unchanged, but was more effective against rickets in children. The general condition of the women improved in spite of the purely local irradiation. No injuries were ever noted with this treatment. — (*Ars Medici, Vol. IX, No. 8 (Aug.) 1931.*)

X-ray Treatment of Chronic Tonsillitis. Prof. G. Schwarz.

Wiener Klinüsch Wochenschrift, No. 18, 1931; *Medizin Klinik,* No. 21, 1931.

This method is successful in 80 per cent to 90 per cent of chronic tonsillitis, i. e. of hypertrophied palatal, pharyngeal, and lingual tonsils. Small to medium doses of hard-filtered Roentgen rays, from the nape of the neck or from the region of the mastoid process, cause a rapid recession of the inflammation symptoms and are a prophylaxis against fresh attacks of angina. Tonsillogenous arthritides and neuralgias recede. In the tonsils irradiated, the disappearance of hemolytic streptococci was bacteriologically demonstrated. In children with adenoids, breathing through the nose is once more free. X-ray treatment is of particular importance when the tonsillectomy is contraindicated, for example, in advanced age, advanced arteriosclerosis, severe infection (danger of cultivation of bacteria) especially in extreme swelling of the regional glands, finally in diabetes, hemophilia, Graves' disease, tb., etc.

The appearance of dryness in the mouth as result of injury to the salivary glands can be avoided with proper technic. If the rays run behind the angle of the lower jaw near the mastoid process in the direction behind-below towards front-up, the parotid gland, the submaxillary, and the larynx are outside the field of the rays. If one does not have a properly constructed tube, the fields are best carefully covered over with eraser rubber. Size of a field 5×7, 6×8. It is best to cut an opening of that size in the middle of a slab of eraser rubber of 24×30 cm., which is then so placed on the face of the patient (who lies on his back with head turned to the side) that the front edge of the diaphragm opening coincides with the posterior edge of the ramus of the lower jaw. The central rays pass through the mastoid process towards the orbit of the opposite side. A single dose amounts to 25 per cent of the SED with filtered radiation. Each side is irradiated three times with an interval of a week between. After every period of six weeks, the series can be repeated once or twice. The involution of the enlarged tonsils begins in the third to sixth week and progresses gradually, the crypts getting flatter and flatter. The tendency to anginal relapses disappears permanently, even if the tonsils do not get much smaller. — *Schulte* (Strahlentherapie, 1930, p. 36) has irradiated 189 cases since 1924. Of these 90 per cent are cured, 6 per cent improved. The author suffered himself for ten years from an angina pseudo-membranacea with relapses every two months, at times also from an a. follicularis. The illness disappeared completely on irradiation, the tonsils have been reduced to a quarter of their hypertrophied size. No other injuries need be feared. — (*Ars Medici,* Vol. IX, No. 8. Aug., 1931.)

Is the Appendix Non-Visualized by X-ray Pathologic?* (Magnesium Sulphate Technic of Examination.) Harold Swanberg, M.D., Editor, The Radiological Review, Quincy, Ill.

If, following an opaque meal, the appendix is not visualized by roentgenologic methods, is it normal or is it pathologic? This question is frequently discussed by roentgenologists and there is no general agreement as to the significance of an ex-ray non-visualized appendix. Many claim that the failure of the appendix to become visualized is without significance, that a non-visualized appendix may or may not be pathologic and that the same statement also applies to the visualized appendix. In other words, the mere presence or absence of the appendicular shadow on the roentgenogram is not the basis of making a diagnosis of appendicitis. On the other hand there are not a few roentgenologists who believe that the failure of the appendix to visualize is a symptom of pathology. In view of the general disagreement as to the significance of the non-visualized appendix, it is interesting to know the teachings of the Holzknecht School of Vienna, representing as it does the views of one of the leading and most progressive roentgenologic teaching institutes.

The Holzknecht School claims that over 90% of normal appendices can be visualized by the x-ray method and the repeated failure of the appendix to visualize is a sign of pathology, but the examination must be made with the special technic of *Czepa.* The essential feature of the technic is to maintain a fluid opaque medium in the caecum and ascending colon which will cause sufficient retroperistalsis to permit the filling of the appendix. The basis of the examination is the use of magnesium sulphate and the following is the technic of this use:

The patient reports to the laboratory in the morning (about 8:00 A.M.) and is given 60 to 70 grams of pure barium sulphate dissolved in ¼ liter of water to which is added three teaspoonsful of magnesium sulphate. Late in the afternoon (about 6:00 P.M.) the patient is examined fluoroscopically and if the appendix is not visualized, is given additional water and barium as above but without magnesium sulphate. The following morning the patient is again observed with the fluoroscope and if the appendix is not visualized, the barium-magnesium sulphate mixture is again repeated. That afternoon, if the appendix has not yet been visualized, the second administration of barium-water mixture is given. On the third morning and afternoon, additional fluoroscopic examinations are made and if these too fail to visualize the organ, it is considered definitely pathologic, the lumen being narrowed or obliterated by inflammation. It will be noted that with the above technic, five negative roentgenoscopic observations are necessary before calling the appendix pathologic.

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* By special arrangement, this article also appears in the February, 1932, issue of "The Radiological Review," Editor.

The magnesium sulphate should produce a mild diarrhoea. If this does not occur, the dose must be increased, while on the other hand, if too frequent bowel movements occur, it should be reduced.

The impression should not be gained that the Holzknecht School teaches that all appendices that are visualized following the above technic are normal. Other findings may be present that will condemn the organ. The appendix to be normal must be completely filled (segmentation is normal, and represents haustrations), present a rounded tip and be free from localized tenderness. If the free end of the appendix is immobile, or it is kinked, it speaks for adhesions, although an accurate diagnosis of appendicular adhesions is frequently a difficult one to make. It should be remembered also, that the appendix may only be visualized after the caecum is empty and that a retro-caecal appendix is not necessarily pathologic. It is important that efforts be made to move the terminal ileum, caecum and ascending colon for the appendix may be buried in the shadows of these parts and only be visualized by careful repeated fluoroscopic observations.

If the appendix is incompletely filled with only about one centimeter containing barium and the barium shadow ends abruptly (without the normal rounded appearance) it is considered pathologic. In fact, the appendix should appear at least two centimeters long to be considered as being normally visualized, less than this length speaks for pathology. If the appendix is incompletely filled with one part at the caecum and the other at the tip, this is considered pathologic (this observation differs from true segmentation). Fecal concretions in the appendix are without significance, neither is a long straight appendix necessarily pathologic (unless fixed in its entirety). Definite localized pain over the appendix, fluoroscopically observed, speaks for pathology.

The author is indebted to Assistant Dr. Karl Presser of the Clinic of Prof. Holzknecht (Zentral Roentgen Laboratory) in the Allgemeines Krankenhaus of the University of Vienna, for reviewing this paper before publication. — *Ars. Medici*, Vienna.

Effect of Roentgen Rays on Healing of Wounds. E. A. Pohle, G. Ritchie and C. S. Wright.

Radiology, **16**:445 (April) 1931.

Eighty white rats were exposed by Pohle and his associates to two qualities of roentgen rays (100 kilovolts, 2 mm. of aluminum; 140 kilovolts, 0.25 mm. of copper + 1 mm. of aluminum) preceding or following incisions in the skin. In the first group, half of each wound extended into previously irradiated skin; the other half remained in unexposed tissue. In the second group, half of each incision was irradiated following the cutting, and the other half was protected. Seven days following the cutting, and also after complete healing, the animals were killed and the skin was prepared for microscopic examination. Irradiation with a dose of 1,000 rays given in one sitting, of either quality of roentgen rays, as defined, from one to thirty days before the incision, did not influence the healing process perceptibly. Irradiation with a dose of 1,000 rays in one sitting, with either quality of roentgen rays immediately, twenty-four hours and forty-eight hours, respectively, after the incisions, retarded the healing process, particularly in the twenty-four hour group, but did not interfere with the final formation of a smooth scar.—*Arch. Derm. and Syph.* (October) 1931.

Recent Advancement in the Treatment of Gonorrhoeal Arthritis in Male. K. Sinha.

The Antiseptic, **28**:847 (December) 1931.

To sum up the proceedings for the treatment of gonorrhoeal arthritis will be as follows:—

If diathermy is available apply the current both to the joints as well as on the seminal vesicles every third day for 20 minutes. No medicine internally nor any external applications in the affected joints are absolutely necessary. After a couple of applications of diathermy you will notice that the inflammation is much lessened. Continue the diathermy as before. Start immediately the treatment for gonorrhoea that is irrigation, massage of the prostate and the seminal vesicles and the dilatation of the posterior urethra according to the rule laid down in the recent treatment of gonorrhoea. By so doing you will not only cure arthritis but also gonorrhoea.

But if diathermy is not available, local application of the affected joints such as 50 per cent icthyol, iodex, etc., becomes necessary. Salicylas though often fails may be tried. Vasotomy in such circumstances should be performed in all cases. After the acute symptoms pass off and the patient feels a bit relieved the instrumental treatment of gonorrhoea should be instituted 'till the patient is absolutely free from gonorrhoea. The following remedial measures advocated by Wolbarst is supposed to be the best. Gonoccoccal arthritis responds in an extraordinary manner to contramine. In acute cases, four intramuscular injections of contramine each of .125 grn. should be made every other day followed by small doses of vaccines and then a series of contramine and vaccine alternately until the trouble has cleared up. In chronic cases 2 or 3 injections of contramine each of .25 grn. should be made at 5 day intervals. After the joint trouble is much less or disappeared the modern instrumental treatment of gonorrhoea should be instituted.

The above method of treatment is only applicable when there is not much accumulation of pus in and about the affected joints. When there is much accumulation radical surgical measures may be necessary, such as joints may be tapped, the fluid withdrawn and the joints irrigated with a hot antiseptic solution. If tapping is not sufficient open operation must be made by incision. — *Author's Summary.*

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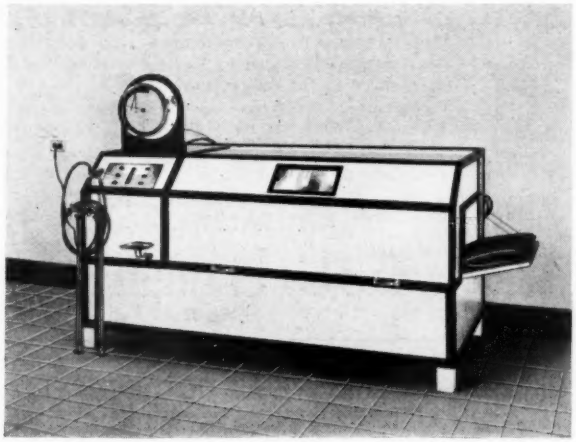

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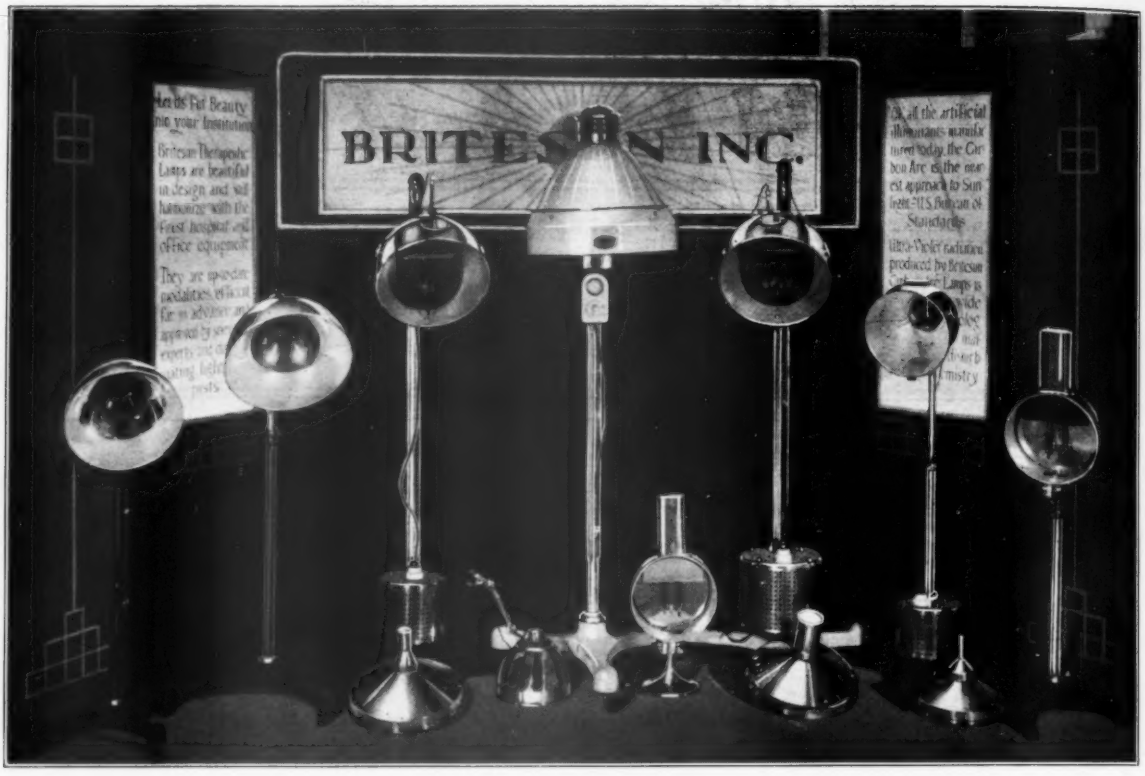

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